Smithsonian

July 1996

DRAGONFLY DAZE

Two calico pennants perch on weeds near a Maine lake (p. 70)

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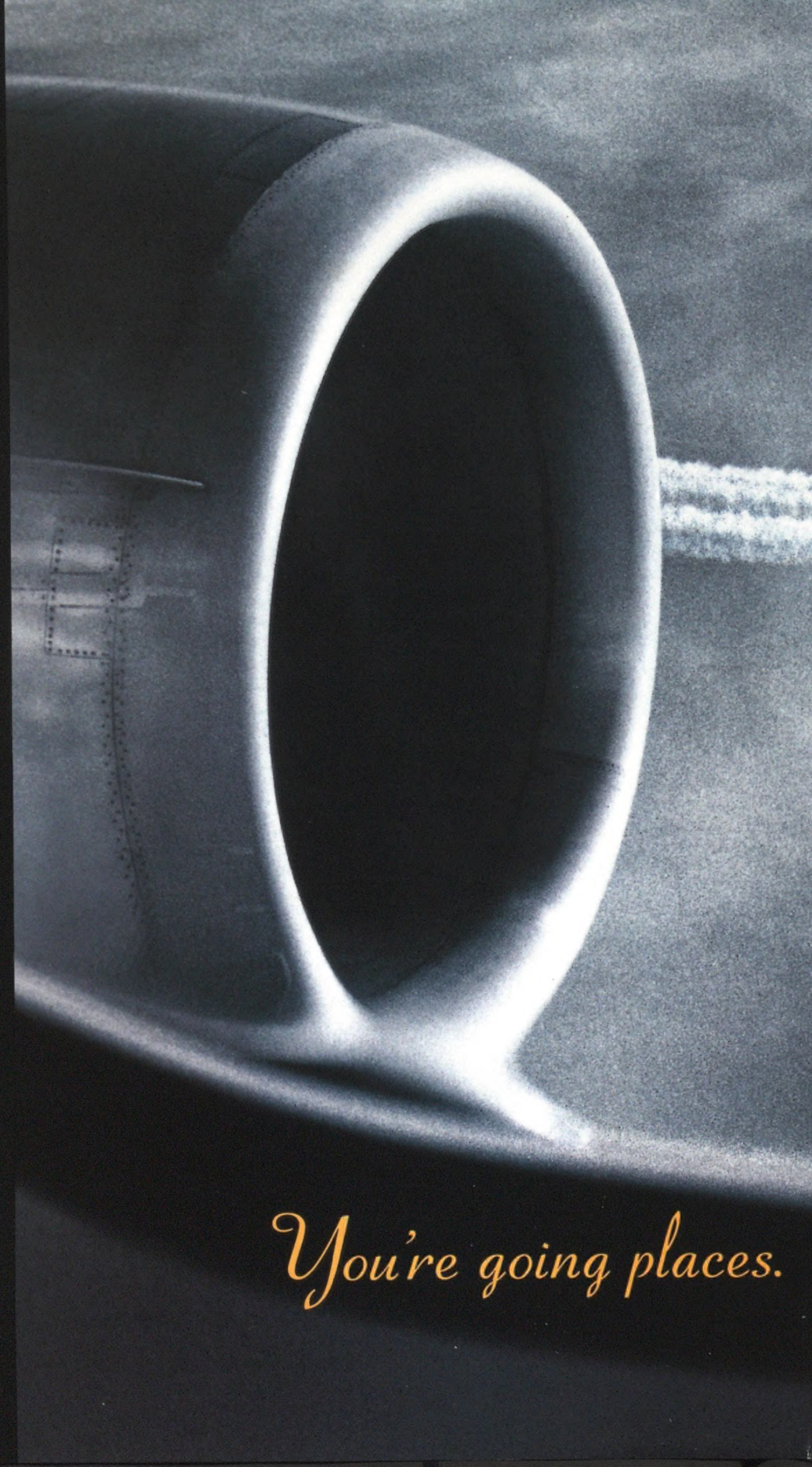

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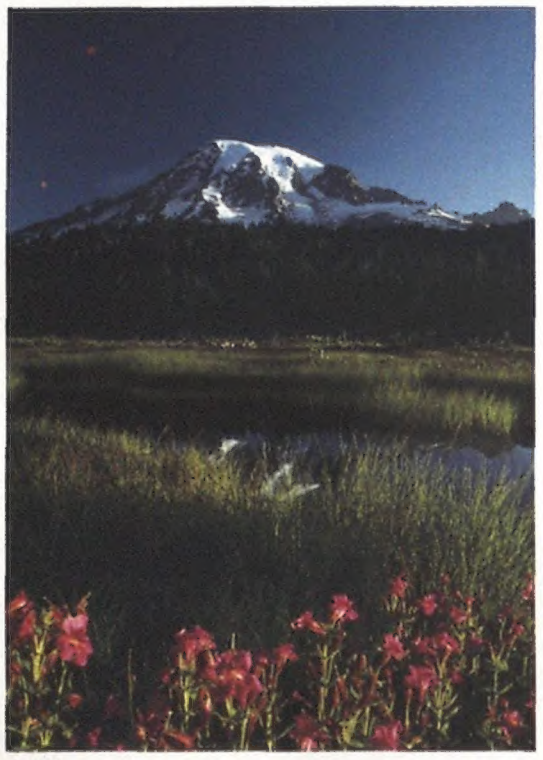
Smithsonian *features*

July 1996
Volume 27, Number 4



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To Address A Serious Health Issue, Mr. Porton Appointed A Steering Committee.

Neither Thomas Porton nor the students in his English class expected to solve the AIDS crisis. They just wanted to help inform other teens about HIV/AIDS in whatever way they could. So Mr. Porton's class created the AIDS Van, a rolling information center fully equipped with displays, brochures and energetic teens.

Because the AIDS Van spread its message face-to-face and teen-to-teen, it was able to get through to kids in ways other awareness programs could not. Eventually, hundreds of students got involved, writing and distributing their own pamphlets, along with those created by government agencies and health organizations.

For proving that the best way to prevent disease is by spreading information, State Farm is pleased to present the Good Neighbor Award to Thomas Porton, along with $5,000 in his name to James Monroe High School of the Bronx, New York.

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of enterprise
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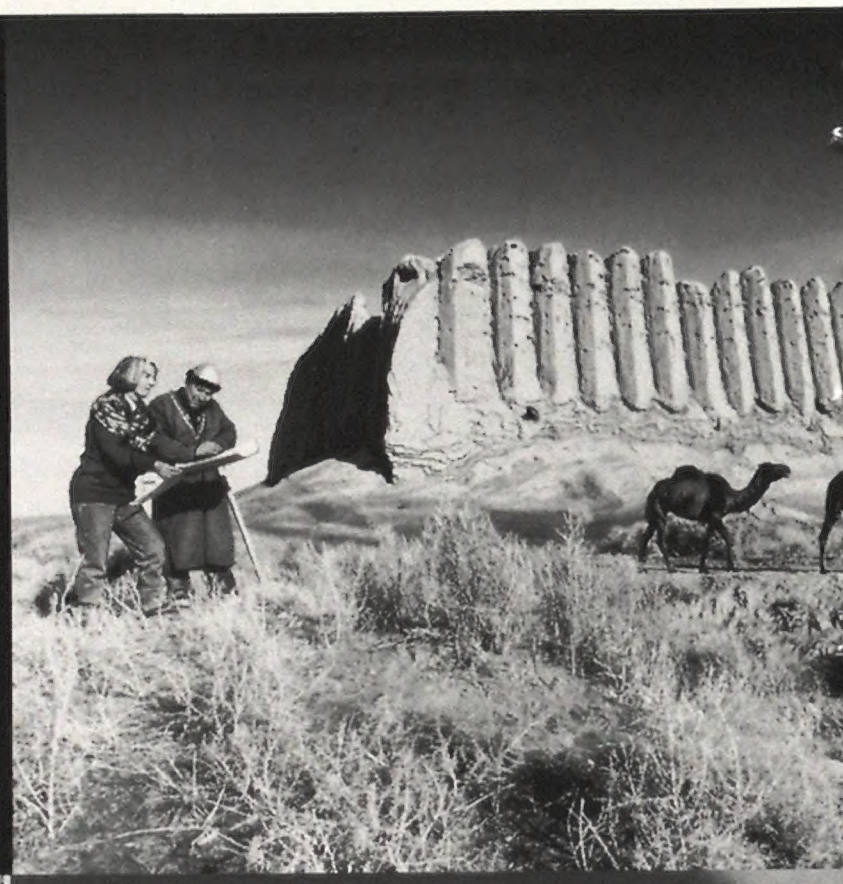
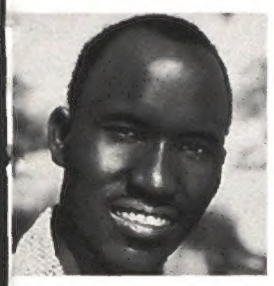


Five remarkable people with five extraordinary callings. Their work may be as diverse in nature as in location, yet each has been granted a Rolex Award for Enterprise. These 1996 Laureates have been singled out from thousands of applicants. They will receive $50,000 and an engraved Rolex Oyster Perpetual Chronometer in recognition of the originality, feasibility and potential of their endeavors, as well as for the sheer courage of their resolve. These enterprising individuals continue in the 20-year tradition set by previous Rolex Laureates who have made valuable contributions in their chosen fields.

At the Yale Medical School in New Haven, Ct., Dr. William Rosenblatt, an anesthesiologist, has devised a method of recovering medical supplies for developing countries. It is routine American procedure to lay out any surgical supplies which may become necessary during an operation. These are discarded afterward, used or not. Dr. Rosenblatt's system provides for the recovery of the unused items for distribution to needy hospitals worldwide. He places the potential recovery at $200 million in materials a year and will use his Award to promote his program, encouraging all major American hospitals to adopt it.



In the remotest villages of Senegal, Sanoussi Diakité is reviving the cultivation of a traditional cereal. "Fonio is such an easy crop to grow. It flourishes in poor soil, with little rainfall," he says. "But unfortunately, husking it is so laborious that these days few women bother to prepare it." Diakité, a mechanical engineer, has single-handedly invented a husking machine which prepares two kilos of grain in just six minutes, a task which takes an hour by hand. The Award will enable Diakité to build more machines for distribution around West Africa, and he hopes ultimately to restore the popularity of this nutritious foodstuff.

In the Kara Kum Desert where British archaeologist Dr. Georgina Herrmann now excavates, the Great Silk Road once passed. It was this which made the now-ruined site of Merv in Turkmenistan one of the greatest urban complexes of the medieval world. "Merv was a series of cities, built side by side," says Dr. Herrmann, "which makes it unique." Having put together one of the largest archaeological expeditions in Central Asia, she has already established that "watered," or "Damascus," steel was being produced here by a complex industrial process centuries earlier than previously thought. Dr. Herrmann will use her Award to fund further excavations and to record and preserve Merv's historic treasures.

Beneath an acacia tree in the mountains of East Africa, Masai elders ceded Dr. Royce Hall land to build an eye hospital. Now the Masai are helping him to build it, and some will receive paramedical training to help him run it, too. In Tanzania and Kenya half-a-million people are blind, often through cataracts, but Dr. Hall, an American ophthalmologist, says that once the hospital is open "we will be able to restore sight to 3,000 people a year." His Award will be put toward the construction of the hospital – costs which he has so far met without help from outside – and will also help ensure its future.

Refurbishing a historic telescope at the Mt. Wilson Observatory in Los Angeles, Gilbert Clark has given schoolchildren in four continents access to the stars. For while Mt. Wilson is in darkness, pupils on the other side of the world can pilot the telescope by remote control and observe stars in real time on their computer screens. "Two schools have followed the course of Pluto," Clark mentions, "and their observations are expected to help NASA better understand its orbit." He intends to use his Award to bring further telescopes into the program and hopes ultimately, through the Internet, to reach a wider audience still.

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If you would like further information or are interested in the next Awards, please write to:
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Smithsonian

July 1996
Volume 27, Number 4

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Cover:
Two calico pennant dragonflies (*Celithemis elisa*) pause with their wings outstretched at Megunticook Lake; the horizontal position of the wings at rest distinguishes dragonflies from their cousins, the damselflies (p. 70)
Photograph by Gary Braasch

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A MAN'S GUIDE *to buying* DIAMONDS

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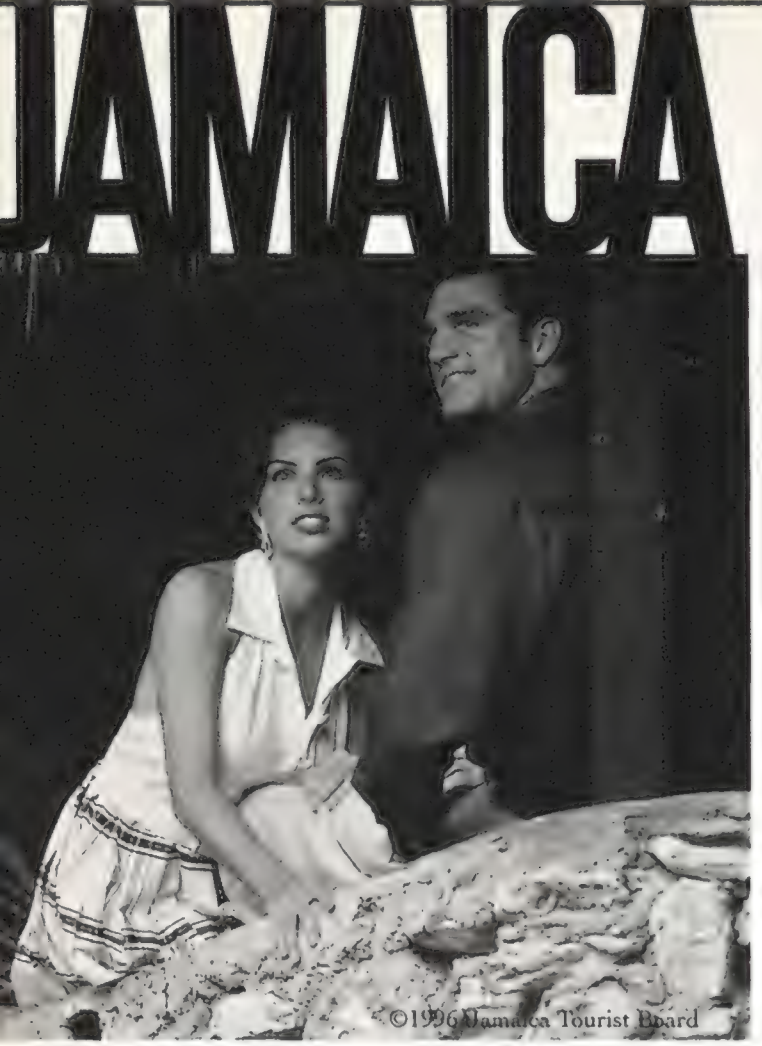

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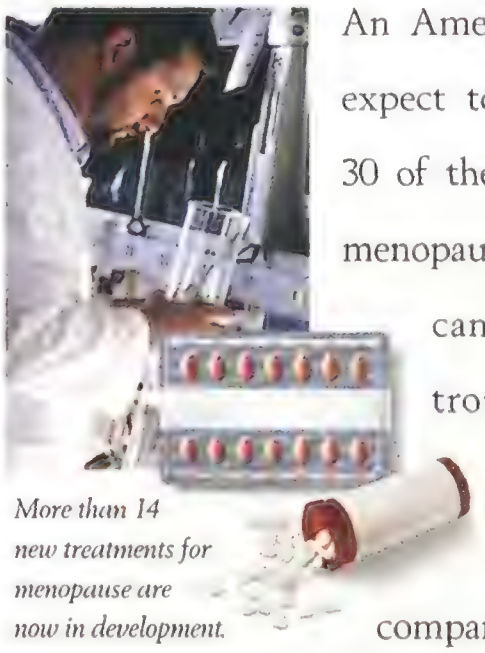

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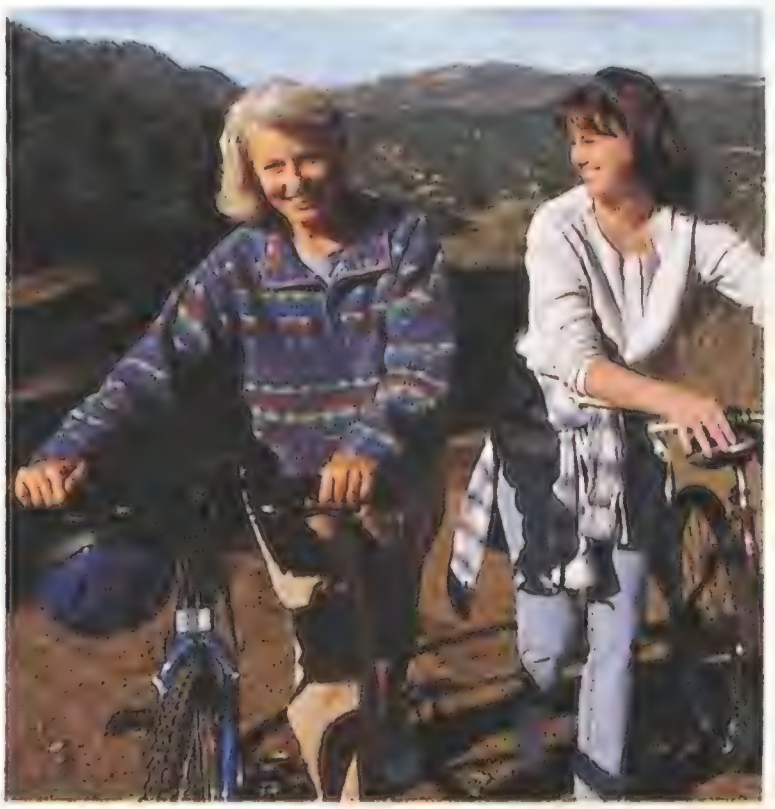

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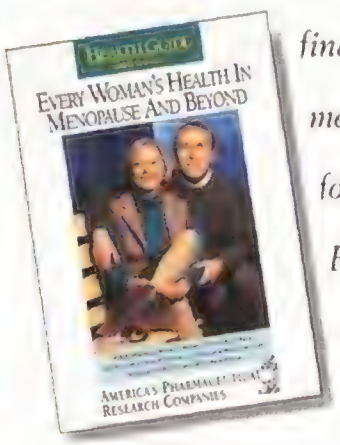

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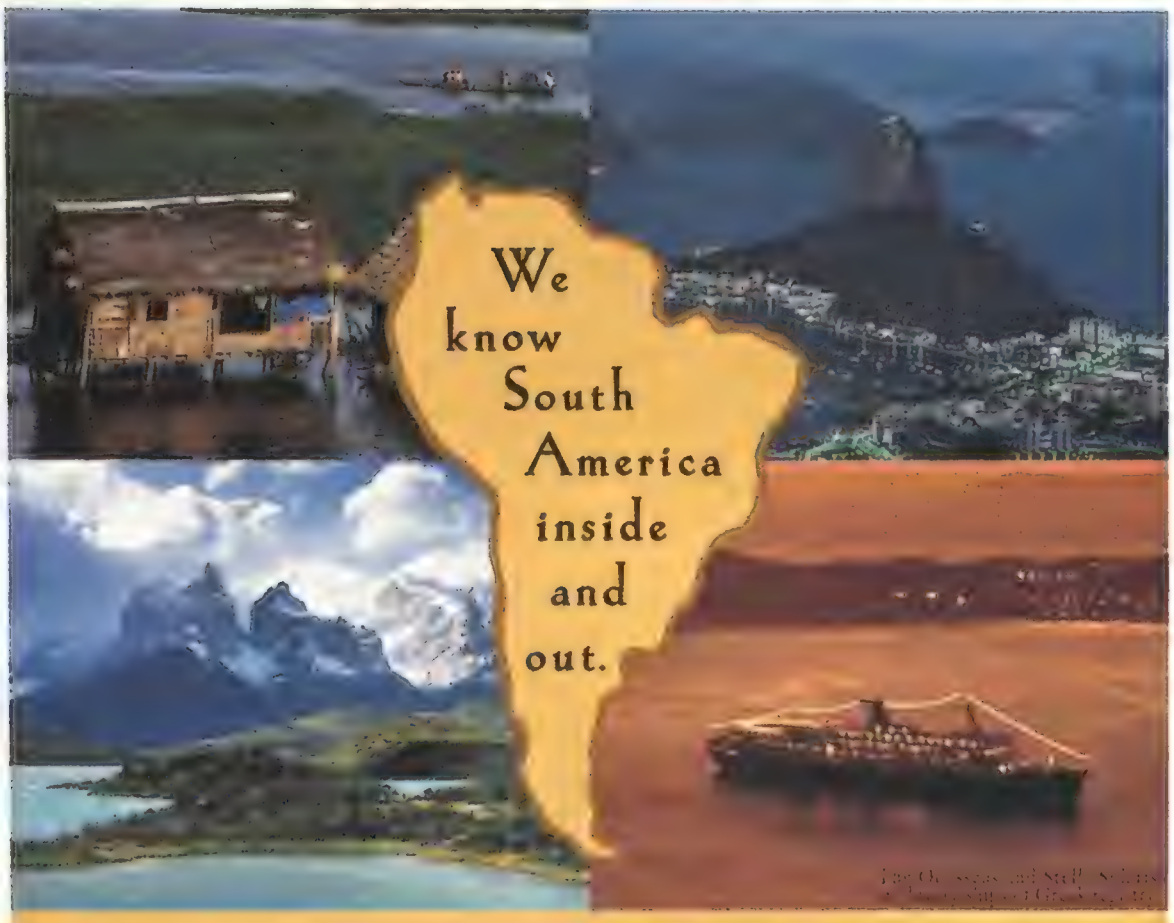

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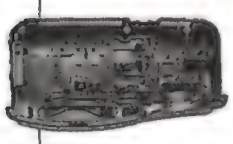

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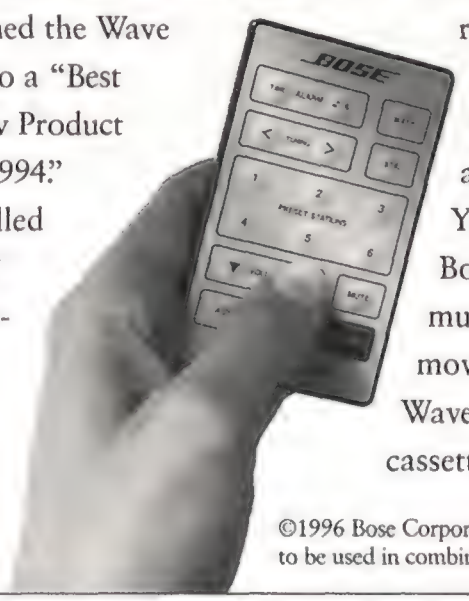

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Secretary Heyman's comments

Smithsonian Perspectives

In the Smithsonian's long history of studying cultures, we've learned to help people represent themselves

The study of human cultures was one of the scholarly foundations Joseph Henry, the first Secretary, planned for the Smithsonian 150 years ago. The very first publication in the Smithsonian's *Contributions to Knowledge* series, *Ancient Monuments of the Mississippi Valley* (1848) by Ephraim Squier and E. H. Davis, explored the remains of prehistoric burial mounds and the peopling of North America. Another early volume, *Systems of Consanguinity and Affinity of the Human Family* by Lewis Henry Morgan, was a seminal work that helped define the field of anthropology. It was, however, Civil War hero John Wesley Powell, explorer of the Grand Canyon and director of the U.S. Geological Survey, who dominated 19th-century ethnological studies. He was the founding director of the Smithsonian's Bureau of American Ethnology, which was devoted to documenting the cultures of American Indians, whose lives were radically changed through U.S. expansion westward across the continent. The Bureau, and later the Department of Anthropology, collected human remains, artifacts, artworks, documentary photographs, and other materials that helped represent people and their ways of life in museum exhibitions.

Toward the turn of the century, an eclectic group of Smithsonian naturalists, anthropologists and artists became interested in representing people and cultures through living displays and public programs. Working with Harvard's Frederick Putnam and his assistant Franz Boas, the father of American anthropology, the Smithsonian helped develop ethnological displays for the 1893 Columbian Exposition in Chicago. Groups of musicians and dancers, priests and camel drivers, and purveyors of traditional arts and industries demonstrated their cultural practices to millions of Exposition visitors. An important milestone in late 19th-century America, the Exposition introduced mass audiences to the Ferris wheel, popular foods, Mayan architecture, and cultural, naturalistic and industrial displays of exceptionally high quality. Organizers thought of the fair as an "illustrated encyclopedia of mankind."

Less inspiring were the ways in which people and their cultures were depicted at the Exposition. In retrospect, the framework for the living exhibitions was an oversimplified evolutionary one. It categorized cultures in racial terms, separating the so-called primitive from the civilized, and drew unwarranted conclusions about moral and material progress and superiority. People were spoken about and displayed as if they were specimens of a type without a voice of their own.

We have come a long way in our human studies. We have learned that the human subjects have a contribution to make based on their own knowledge and insights. Ethnologists in our Department of Anthropology have, over the past generation, encouraged studies of "folk knowledge," ethnoscience and indigenous systems of classification, and cultural and artistic expression.

Nowhere at the Smithsonian is this so dramatic as at our annual Festival of American Folklife on the National Mall. Initiated in 1967, the Festival has blossomed as a stimulus for research, and the production of documentary films, recordings, educational materials and training programs. The Festival has provided a model for other types of cultural work around the nation and around the world.

The Festival's basic aim is to foster the engagement between people and the scholars who seek to represent them, and between those displaying their cultural traditions and an appreciative, learning audience. A far cry from the Columbian Exposition, those represented at the Festival work with Smithsonian staff to research and develop their own presentations. They speak for themselves, confront our scholars, and even occasionally challenge the public.

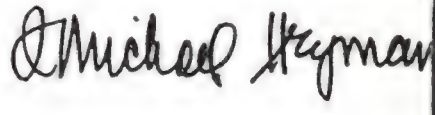
Consider this year's Festival program "Iowa—Community Style," where some 60 individuals, including professors and meat packers, and numerous organizations conducted research on scores of grass-roots traditions across their state. Ideas were developed on how to present Iowa's cultural life at this Festival (June 26-30 and July 3-7). Iowans will take their presentation home to celebrate their sesquicentennial of statehood.

Similarly, "The American South," another program on the Mall for the Festival, will be remounted in Atlanta's Centennial Olympic Park as "Southern Crossroads," part of the Olympic Arts Festival during this summer's Games. Some 250,000 visitors a day, and many more through electronic coverage, will learn how distinctive forms of expression such as blues, gospel, jazz and rock'n'roll became an American and, indeed, a worldwide phenomenon.

Over the past generation, the gap between the cultures that are represented and the curators of culture has narrowed. Recent Festivals have featured the customs, tales and worklore of White House staffers, city taxicab drivers and even trial lawyers. This year, on the occasion of our own 150th anniversary, the Festival presents "Working at the Smithsonian." In taped interviews conducted across the Institution, some 300 researchers, curators, conservators, docents, educators, plumbers and horticulturalists will share their occupational culture with visitors.

Powell and other early figures would be bemused that their ethnological studies had led to documenting and sharing with visitors the tales of museum security officers, the artistry of scientific illustrators, the acumen of fundraisers, the skills of exhibit makers.

Neither amusement nor menagerie, the Festival's goal of cultural education and inspiration will certainly be apparent in this 150th anniversary edition.



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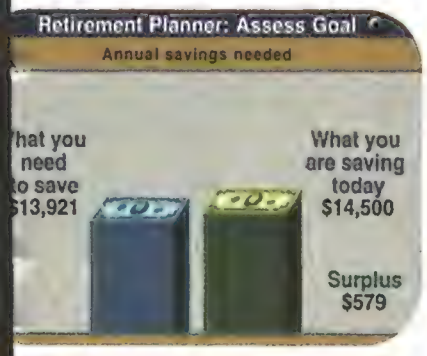
"when i retire?
i want to
collect American
folk art.


Retirement Planner: Assess Goal
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What you need to save $13,921
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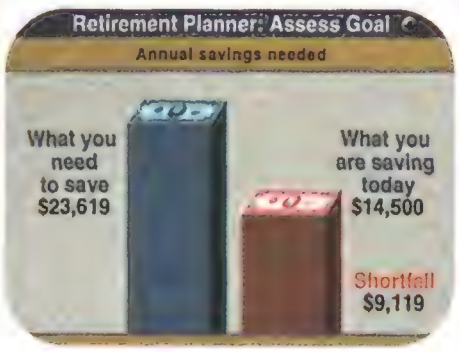
i'm even thinking
of buying
a bed & breakfast
to show it off in.


Retirement Planner: Assess Goal
Annual savings needed
What you need to save $23,619
What you are saving today $14,500
Shortfall $9,119

do you
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get more
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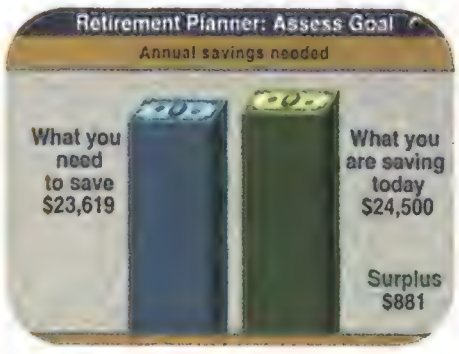
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Letters to the Editor

Suyá

Thank you for David Roberts' May 1996 article "The Suyá sing and dance and fight for a culture in peril" with accompanying pictures by Enrico Ferorelli. How can I help?
Harvey McGhee
Asheville, North Carolina
The Suyá welcome donations to purchase badly needed medical supplies, for transportation and other necessities, and to support their activities to regain lost lands and further their own development projects. You can contribute to the Suyá by sending a check in care of Anthony Seeger. *Please make checks payable to* Cultural Survival, Inc./Suyá. *For more information, to contact Mr. Seeger or to write to the Suyá, post letters to* Anthony Seeger, Smithsonian Institution, 955 L'Enfant Plaza, Suite 2600, Washington, D.C. 20560 or call (202) 287-3261 or fax (202) 287-3699. *Mr. Seeger and Mr. Ferorelli are working on a book about the Suyá, and Mr. Ferorelli is selling his photographs of them. The proceeds from both projects will be shared with the Suyá.* Ed.

America's Smithsonian

We were sorry not to have seen the "America's Smithsonian" exhibition while it was here in Los Angeles. It was such a great success. Although the huge crowds and long lines kept some of us away, the article "The nation's treasures take to the highway for a 12-city tour" by John F. Ross, with pictures by Kay Chernush, did go a long way to cure our disappointment.
Charlotte Semple
Los Angeles, California

Isaacs Collection at NMAA

In the picture essay about the Isaacs Collection, a recent acquisition of the National Museum of American Art, you show a photograph by William Underwood of Joe Mell, "Passamaquoddy guide," on page 117. Joe Mell lived in Washington County, Maine, and was well known there. He was a master craftsman who made fine canoes and paddles that have never been equaled. He traveled to Mexico with Mr. Underwood (of deviled ham fame). He was a good friend of Rob Golding—an outstanding nearby farmer and woodsman—and was often mentioned in Rob's stories and reminiscences. These are on tape and held at the archives of the University of Maine at Orono.
Mary Stewart Hafer
Bedford, Massachusetts

Giant squid

In response to Richard Conniff's article about Clyde Roper and the giant squid, I can add that the cephalopods are in a "class of their own" in two other ways. First, living cells in all creatures contain a negatively charged ion (anion) called chloride, as in potassium chloride or sodium chloride (table salt). The exception is the nerve cells of the cephalopods, where half of the anion content is isethionate—an alcohol molecule with sulfate on one end.

The other striking property is that the nerves of the cephalopods contain an enzyme that can destroy and thus render harmless a group of compounds that the popular press refers to as "nerve gases," which includes sarin, the culprit in the Tokyo subway deaths.
Francis C.G. Hoskin
Marine Biological Laboratory
Woods Hole, Massachusetts

Object at Hand

I very much enjoyed reading Edwards Park's informative and interesting piece on James Smithson, the gold sovereigns and the founding of the Smithsonian Institution. Let me point out, however, that the federal government's budget expenditures in 1838 were $33,865,000, not "about $34,000" as the column stated. Our government was relatively frugal in those days, but not that frugal.
Donald R. McCoy
Lawrence, Kansas
Mr. McCoy is correct. Ed.

Editor's Note

In Don Moser's "150 Candles for the Smithsonian," he writes, "At any given moment, Smithsonian scholars and scientists might be transcribing the complexities of Duke Ellington's 'Take the "A" Train.'" That great song was composed by Billy Strayhorn—Duke's great friend and collaborator—and ended up being the Ellington band's theme song.
William H. Young
Professor of American Studies
Lynchburg College in Virginia

Dingbat

I don't know what it is called, but thank you for putting the little castle symbol at the end of each story in the current issue. You have at last fixed the only thing I have ever found wrong with your stories: how to know when they end.
Bill Wickman
Salem, Oregon
A symbol such as our castle is commonly known as a dingbat. Ed.

Letters for consideration in this column must include your full name, telephone number and postal address. Transmit mail to edletters@aol.com or post mail to Letters Editor, SMITHSONIAN *magazine, 900 Jefferson Drive, MRC 406, Washington, D.C. 20560*

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Around the Mall and Beyond

By Michael Kernan

After many an 18-hour day 'tinkering,' and more than 500 patents to his name, Jerome Lemelson is America's most prolific living inventor; now he's giving a leg up to others

Lemelson, whose inventions include brakes for in-line skates, holds a pair patented in 1925. The $10.4 million Jerome and Dorothy Lemelson Center was funded by the largest gift ever given to the Smithsonian by an individual.

"Don't cut back on basic research. It's necessary to the future of this country. That's my message." Jerome Lemelson, the most prolific living American inventor with more than 500 patents to his name, was talking to us at a celebration of the Lemelson Center for the Study of Invention and Innovation, at the Smithsonian's National Museum of American History, and as usual he wanted to talk about other inventors.

There was Paul MacCready, who created the wonderful Gossamer Albatross, the plane you pedal like a bike. A beautiful toy? An impractical dreamer? Oh no. MacCready and his colleagues have now developed his vision into a flying wing powered by solar cells. It has already flown for 11 hours straight, as high as 50,500 feet; eventually, it will take impossibly detailed photographs of Earth.

There were Herbert Boyer and Stanley Cohen, winners of the $500,000 Lemelson-M.I.T. Prize for their pioneering work in gene splicing, "which revolutionized biotechnology and was key to the whole biotech industry." And Wilson Greatbatch, inventor of the implantable pacemaker.

These inventions came out of basic research, Lemelson says, and penny-wise members of Congress should never forget that.

He should know. Because it was his 18-hour days of tinkering that led him to invent the major components in the now-universal automated factory, the tape drives on compact cassette players, including the Walkman (licensed to Sony in Japan after American firms turned him down, and subsequently farmed out to more than 100 firms), and other devices from injection molding controls to brakes for in-line skates.

"And I received the first patent on the Camcorder," he adds casually when I talk to him later in the Presidential Suite, no less, of the Willard Hotel.

The Lemelsons came to Washington to formally christen the Jerome and Dorothy Lemelson Center, funded with the largest cash donation ever given to the Smithsonian by an individual. I was taken on a whirlwind tour, and I can tell you that this modest set of hushed little offices, squeezed in among a display of patent models from the past (the "Arithmometer," a paper bag machine, an early calculator), roars and bustles like Times Square. Conceptually speaking, you understand.

The center runs symposia on innovation and society; an archival program that collects oral and video histories, and offers electronic locators of living inventors' papers; a terrific website (http://www.si.edu/organiza/museums/nmah/homepage/lemel); fellowships and internships; and school programs to encourage young inventors.

The last is a particular concern of Lemelson's. The young, he says, are too media-driven and preoccupied with entertainers and athletes; better if they stop being spectators and identify with inventors, scientists and engineers.

Only a little more than a year in operation, the center is already attracting historians, according to director Arthur Molella. But also hopeful inventors. "Just the other day," Molella says, "a man called me about marketing some cardboard binoculars (you can put ads on them), and it turned out he was a former Philadelphia cop who was badly wound-

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ed and started a new life as an inventor. It seems his great-great-uncle invented the shin guard and the batting helmet and is in the Baseball Hall of Fame."

The center, Molella adds, is getting a special constituency: the independent inventor who has to deal not only with global competition but with lavishly financed corporate inventors. "We *cannot* assist them in applying for patents. But we often hear about their plight, and we can be an information center and help document their ideas. Of course, we're eager to document the corporate ones, too. We want to bring together the scholars and the practitioners. It's not our goal at all to seal ourselves off as historians. Our main audience is the public."

Recently the center got inventor Jacob Rabinow onto National Public Radio's *Soundprint*, and, for a series called "Innovative Lives," sponsored a lecture by Stephanie Kwolek, the inventor of the ultratough material called Kevlar. There will be a symposium on the electric guitar featuring one of its pioneers, Leo Fender himself. Music and other arts are an important part of the whole scene, Molella notes.

The Lemelson Center highlights the work of student inventors, including E-Teams (*E* for excellence and entrepreneurship) from Lemelson-sponsored programs at Hampshire College, M.I.T. and the University of Nevada, Reno. The Reno E-Team is working on an instant rent-a-car system as a new approach to cheap and efficient public transportation. Satellites will track the exact location of each car—you'll simply call in your credit card number to reserve one at a corner near you.

Lemelson Center programs for kids use the Hands On Science Center, part of the "Science in American Life" exhibition at American History, which lets visitors conduct some two dozen scientific experiments and gives science teachers a computerized data base of resource materials. In its first year the Science Center, sponsored by the American Chemical Society, had 150,000 visitors, which proves to me at least that people are sick of sitting in front of the TV and want to do stuff themselves. The Lemelsons have also set up the National Collegiate Inventors and Innovators Alliance at Hampshire and given seed money for a Nevada Office of Science, Engineering and Technology.

How does a great inventor start? As a kid on Staten Island, New York, Lemelson built model planes, which naturally led him into the U.S. Army Air Forces in World War II. He followed that with degrees from New York University, where he worked on the Navy's Project Squid, experimenting with pulse-jet engines and rockets. America had studied the German V-1 buzz bomb and actually built 2,000 of them, but we dumped them off Okinawa when the war ended, he says. His own contribution had to do with the afterburner.

"I was taking a course in patents and their management at NYU, and we were told to find a problem and see if you could solve it, so I drew up an application for a magnetic typewriter eraser that would stick on the side of the typewriter so you wouldn't lose it." He filed and paid the $30 fee but was told it had already been done. And he lost the fee.

Meanwhile, he met his future wife, Dorothy, an interior designer, in 1953, married her the next year and, while working as an engineer, kept inventing in his off-hours. I want to know how it felt when he started inventing full time in 1958. So far, Lemelson is sounding a bit like his own résumé. But Dolly Lemelson, who has been listening carefully all this time, breaks in. "One day it was snowing, and Jerry didn't want to go to work, and he said, 'If I go to work today I'll quit.' And that's when it started."

The first big breakthrough was the automatic warehousing system, 25 years ahead of its time, with patents in 1962 and '64. Today the stacker crane that runs on an overhead monorail with computerized storing and retrieving is a familiar sight all over the world. Lemelson tied it in with his flexible manufacturing system, which lets an assembly line produce different products at the same time, with computers controlling the whole operation. Now practically every car factory on the planet and most electronics firms use this system.

Surely the intelligent production line is the most important advance in manufacturing since Henry Ford's basic manned assembly line. And Jerome Lemelson owns a big piece of it.

Among Lemelson's early inventions was a flexible track car-racing toy. After many years (the average time between conception and bringing a product to market is seven years) a patent was issued, and it became the most popular racing toy ever. But Lemelson never made a cent in royalties; he says a major toy company pirated his concept.

A patent holder might get up to a 25 percent royalty if few items are produced; for a toy it might be 5 percent; for a Disney-type character, up to 12 percent. "Mine range from a fraction to about 7 percent," Lemelson says.

As often happens, one idea sets off another. It was Lemelson who gave industrial robots a photoelectric eye and then replaced it with a video camera. It was Lemelson who digitized the camera's analog signal, enabling it to scan and analyze things thousands of times faster than the human eye can.

This means that a microchip with its millions of switching elements can be inspected in a fraction of a second by machine vision instead of in weeks or months by a person at a microscope. Imagine what that meant for the computer industry. The same techniques can be applied to car assembly, to ensure the quality of welds and paint finishes, for example.

Lemelson got patents on important parts of VCRs, ATMs, cordless phones, fax machines and personal computers, and in the '60s he tried to patent a process for making compact disks. He didn't succeed, but he did get a patent on laser recording that he has now licensed to companies around the world.

"I used to have a workshop in the cellar," the 72-year-old Lemelson recalls, "and I built a lot of my own models. Now I have consultants. For the last 40 years or so I'd sit down and sketch and write and was my own patent attorney."

Dolly: "That's an understatement. He gets up in the morning, exercises, showers, starts work, and around 10 or 11 he has breakfast. We generally go out for dinner, but between meals and after, he is working. Until 12 at least."

He has an amazing capacity for work, she adds. He can sit down and work anyplace, on a sofa at their Lake Tahoe place, in bed, in the car, on a plane. He never gets blocked. "The most horrible thing is to have someone tell you in the car, 'I have this idea, write it down for me, will you?' In the middle of the night he'll get up and write ideas down. And the kind of writing he does is a full exploration of the problem."

Today Lemelson is concentrating on electronic educational systems, and medical inventions. For starters, computer-assisted surgery.

Gee whiz. As it is, the man has changed all our lives. Now he may end up saving them.

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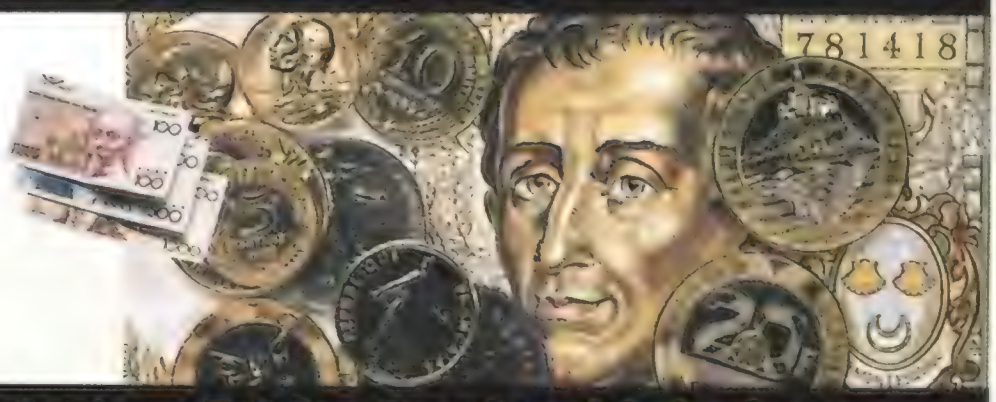
You know how to get a bite without a big bill in Rome.



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The Object at Hand

By Edwards Park

How an upside-down biplane on a 24-cent stamp, now on display at the Smithsonian's National Postal Museum, seemed to jinx early attempts at carrying the mail by air

The people over at the Smithsonian's National Postal Museum call it the Jenny Class Reunion. But there are no drinks, songs or hotel hospitality rooms crammed with loud and aging humans. It is simply a gallery with 23 silent and splendidly preserved postage stamps on decorous display. One of them belongs to the Smithsonian. The others are on loan from generous owners around the country.

To a layman, the Inverted Jenny is just a 24-cent stamp, red with a blue picture of an old-fashioned biplane—but oops! The plane is upside down. To a pilot it pictures an ancient Curtiss JN-4, or "Jenny," apparently at the top of a loop or in the middle of a slow roll. To postal officials it's an embarrassing error that regrettably stumbled into circulation. Only 100 examples slipped past printing inspectors and made their way to the public at the tag end of World War I. All 100 instantly became collector's items. To philatelists, each one is worth about $100,000, depending on its condition. Quite a return on an original investment of 24 cents, though in 1918 for that sum you could buy four glasses of beer with change left over.

"Ever since we were given ours about 30 years ago," says James Bruns, director of the National Postal Museum, "philatelists have planned their vacations around a visit to Washington just to look at it. When they arrive and find it's hidden away, they complain and write nasty letters. But we can't put it on permanent display if we want our grandchildren to see it."

Why? Because of that old museum curator's bugaboo: ultraviolet light. The stamp's perimeter, the "frame," is red, an unstable color. Ultraviolet light would gradually fade it, turning it orange. It's OK, however, to showcase this Smithsonian treasure for short periods. So, in order to atone for past disappointments, and to celebrate the Institution's 150th birthday, our Inverted Jenny is being reunited with those others to provide a feast of philatelic rarities worth more than $2 million. The 23 stamps will be on display at the Postal Museum (SMITHSONIAN, August 1993) from July 30 through September 30.

"This is our first big-time exhibit," Bruns says with pride—and a touch of stage fright. "We have to cope with insurance and security."

The stars of the museum's show are airmail stamps offered for sale on May 13, 1918, in time for the first official airmail flights, two days later. On the morning of the 14th, avid Washington, D.C. collector William T. Robey showed up at a post office on New York Avenue near 13th Street. He was looking for errors and knew that the last minute rush to print, as well as the two-color printing process, would make the stamps especially vulnerable to discrepancies. He knew that stamp collectors would pay high prices for those errors, but he probably never imagined just how high.

Though $24 was serious money back then, Robey decided to get a sheet of 100 stamps. The details of what happened that day are varied, but one version recounted by Robey in 1938 describes how he went back to the post office and asked the clerk if any more airmail stamps had come in. "He brought forth a full sheet," Robey said, "and my heart stood still." The image was upside down! "It was a thrill that comes once in a lifetime," said Robey.

The clerk scanned the sheet but did not hesitate to hand it over. Robey asked if he had more sheets just like it. "At that," says Jim Bruns, "the clerk smelled a rat, and closed his window."

Laying the sheet carefully in his briefcase, he went back to work. There he quickly set about notifying friends and

In Philadelphia, first stop on the first official airmail flight to New York, May 15, 1918, a postal truck transfers letters to a waiting Curtiss JN-4.

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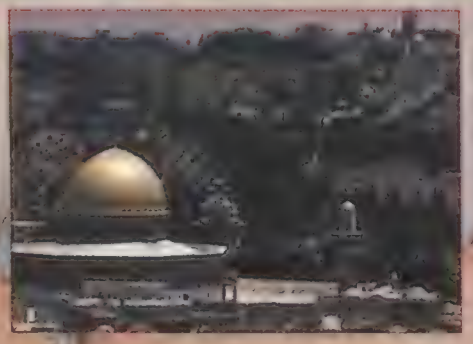

Itinerary in Brief

Day 1
Depart USA

Days 2-3
Cairo, Egypt/
Hotel Semiramis Intercontinental

Days 4-5
Cairo/Fly to Luxor/*Hilton Hotel*

Day 6
Luxor/Hurghada/Embark *Panorama*

Day 7
Little Gubal Island

Day 8
Sharm El Sheikh for
St. Catherine's Monastery

Day 9
Nuweiba for the Colored Canyon

Day 10
Eilat for Petra, Jordan

Day 11
Eilat/Disembark Panorama/Masada/
Dead Sea/Jerusalem, Israel/
Jerusalem Sheraton Hotel

Days 12-13
Jerusalem

Day 14
Jerusalem/USA

Tour Dates

Depart USA	Return USA
Dec. 20, 1996	Jan. 2, 1997
Dec. 26, 1996	Jan. 8, 1997
Dec. 30, 1996	Jan. 12, 1997
Jan. 5, 1997	Jan. 18, 1997
Jan. 15, 1997	Jan. 28, 1997
Jan. 19, 1997	Feb. 1, 1997
Jan. 25, 1997	Feb. 7, 1997

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collectors of his find. It wasn't long before a couple of postal inspectors arrived. One of his coworkers, upon hearing of Robey's good fortune, had gone off in search of more inverts and had told postal officials where they could find Robey.

The inspectors were extra polite. Had he just purchased a sheet of 24-cent airmail stamps with an inverted center? "Yes." "Would it be too much trouble to show it to us?"

"Sorry." "Would you be interested in selling it back to us?"

"Sorry." If the expression "No way!" had been in vogue in 1918, it would have sprung to Robey's lips.

Politeness aside, the inspectors then threatened that the government would confiscate the sheet. Robey went home that evening and hid the stamps under his mattress. He knew that official pressure would increase. So he got in touch with some well-known philatelists. One Eugene Klein of Philadelphia snapped up Robey's sheet of stamps for $15,000. Exit Robey, whistling happily. Enter Edward H. R. Green (son of the miserly financier Hetty Green, the fabled "Witch of Wall Street"), who paid Klein $20,000 for the sheet of upside-down Jennies.

Green broke the sheet up, dispersing individual stamps and blocks of four to collector friends. "The condition of some of those stamps has deteriorated since 1918," says Bruns. "Four were stolen; two, recovered. The thief cut off the perforations so the stamps wouldn't be recognized. Perforations are like a stamp's fingerprints, you know. They fit like pieces of a puzzle."

Robey's sheet, ten stamps across by ten down, had been cut along its top and right side. That gave 19 stamps straight edges, nine on the top, nine on the right, one at the corner with both top and right straight-edged. The story goes that Green went to a stamp collector's club, put some of the straight-edged stamps into an ashtray and announced that he was about to burn them. He wanted all present to bear witness to this destruction. The remaining stamps would be the pedigreed thoroughbreds of philately.

"The other members were horrified and made him stop," says Bruns. "So he took the straight-edge stamps home and put them in a safe. After his death in 1936, they again came to light—by then all stuck together." Unsticking them with water removed the gum. Ours is one of those—gumless, with a straight right edge. It's worth about $120,000.

Most printing errors involve either an inverted plate or a sheet fed improperly to the printer. And most are caught quickly, either by a print inspector or a postal clerk. But the clerk who sold that sheet to Robey didn't spot the mistake. Asked about it later, he replied, "How was I to know the thing was upside down? I never saw an airplane before."

In May 1918 the Curtiss JN-4 was one of only a few American military aircraft in full production. Our hope of quickly snuffing out World War I by darkening the skies over France with American-designed "aeroplanes" had come down to this: a lunky training plane, whose prototype had been built in England.

It was awkward and slow, with few instruments. *Practical Flying*, published in 1918, advised pilots that the best way to avoid skidding or slipping in a turn was to keep an eye on "a piece of string or tape fastened to a strut." You judged a Jenny's airspeed and power largely by listening to the clatter of engine valves and the changing pitch of wind shrieking through the web of wires. The Jenny had wooden skids on the underside of each wingtip to guard against damage in a ground loop—not uncommon because the plane's wheels were about as close together as a flounder's eyes.

When the war was over, the planes went on sale, and many a pilot who had trained in Jennies coughed up $300 or so for a surplus job and took up barnstorming, flying folks for 10 or 15 minutes, charging by the pound for the ride. Pilots found the original 90-horsepower Curtiss OX5 engine dangerously feeble; many replaced it with a Hispano-Suiza ("Hisso"), turning up as much as 150 horsepower. Hisso-powered Jennies were assigned to fly the first official U.S. airmail. Those are the planes on the 1918 airmail stamps, all flying purposefully straight and level except for those 100 aberrations that sputter along on their backs, doubtless spewing a mixture of hot oil and radiator water.

On May 15, 1918, two Jennies loaded with letters were to take off simultaneously from New York and Washington, land in Philadelphia and switch the mail to new planes with fresh pilots (as though at a Pony Express relay station) who would fly on, one to Washington, the other to New York.

President Wilson, scores of dignitaries and thousands of spectators showed up to watch at Washington's Potomac Park. The Washington to Philadelphia flight (SMITHSONIAN, May 1982) soon proved a fiasco. The pilot, Lieut. George Boyle, was fresh out of flying school, where he seems to have studied his fiancée more closely than aerial navigation. Since she was the daughter of the Interstate Commerce Commissioner, political clout got Boyle this pioneering mail mission, guaranteed to chisel his name in the annals of flight.

Pioneering airmail pilots often had to parachute to safety—or crash-land.

It did, all right. Hurrying to the field, he barely scanned a road map, then took off, just squeaking over the trees. Sublimely confident, he headed south instead of north. Soon lost, he landed on a soft field 25 miles away, nosed over and broke his propeller.

Two days later, he got a second chance, a new prop and another load of mail. Told to keep the Chesapeake on his right and thus pick up his course for Philadelphia, Boyle obeyed so mindlessly that he turned right at the top of the bay and headed back south down the Eastern Shore, the water of course still to his right. Eventually he reached Philadelphia but picked the wrong field and cracked up on landing. It had taken him three days to fly the 140 miles from Washington.

Despite Boyle, U.S. airmail managed to get off the ground in 1918. Pilots braved dreadful weather, night flights without navigation aids, blind landings, engine failures. Many bailed out, joining the "caterpillar club" or "hitting the silk" successfully. Many died. Today airmail is taken completely for granted. Not so the misbegotten stamps designed to mark its first official flight.

Smithsonian Highlights

Plan a Smithsonian visit in 1996!

Join in the fun as the Smithsonian celebrates its 150th anniversary with a year of special exhibitions and events. *Receive a free Associates' planning packet.* Write Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560, or call 202-357-2700 (voice) or 202-357-1729 (TTY), 9 A.M. - 5 P.M., Monday-Friday; 10 A.M. - 4 P.M., Saturday-Sunday. *Note:* Parking near the Smithsonian is limited. The convenient Metrorail subway has parking available at some stations (details in packet). Begin your visit at the Smithsonian Information Center's Associates' Reception Desk—open 9 A.M. - 4 P.M. daily—in the Castle.

Smithsonian museums are generally open 10 A.M. - 5:30 P.M. daily, except December 25. Hours at the National Zoo are 9 A.M. - 4:30 P.M. daily for buildings, and 8 A.M. - 8 P.M. for grounds.

Art Night on the Mall
The Sackler, Freer, Hirshhorn and African Art museums will be open Thursday evenings until 8 P.M. through August 29. The Ripley Center's International Gallery and the Hirshhorn's Full Circle Cafe will also remain open.

Festival of American Folklife
The 30th annual Smithsonian Festival of American Folklife is being held on the Mall, June 26-30 and July 3-7, from 11 A.M. to 5:30 P.M., with dance parties and concerts from 5:30 to 7 P.M. daily.

'America's Smithsonian'

New York Coliseum, New York City
(through July 24) Special traveling exhibition showcases such Smithsonian treasures as Abraham Lincoln's top hat and a Moon rock. *Note:* Admission is free, but passes are required. Advance passes are available for a service fee of $3.50 each by calling 1-800-913-TOUR.

Special July Exhibits, Events

Arts and Industries Building
Visual Journal: Harlem and D.C. in the Thirties and Forties (through September 29) Images by African-American photographers chronicle black communities. See *Highlights Continued*, page 28.
Discovery Theater
For showtimes, ticket prices, reservations, call (202) 357-1500 (voice or TTY).

National Air and Space Museum
The Enola Gay (runs indefinitely) Exhibition features the forward fuselage of the *Enola Gay*, the B-29 that dropped the atomic bomb on Hiroshima.

National Museum of Natural History
Eyes on Science: Illustrating Natural History (July 3-January 1, 1997) Exhibition looks at artists and works that have helped further scientific knowledge.
Gems and Minerals Hall Gallery is closed until late 1997. The Hope Diamond is on view on the second floor of the Rotunda.

National Zoological Park
Think Tank New permanent exhibit explores the biology and evolution of animal thinking, focusing on orangutans.

National Museum of American History
Building a National Collection: 150 Years of Print Collecting (through February 1997) An overview of the history of print collecting in America.
Science in American Life Permanent installation tracks advances and discoveries in science over the past 125 years.

National Postal Museum
Located next to Union Station on Capitol Hill, the museum traces the history of the nation's mail service.
The Jenny Class Reunion (July 30-September 30) See *Object at Hand*, page 24.

The Castle—Great Hall
Smithson's Gift New permanent display tells the story of the British scientist whose bequest founded the Smithsonian 150 years ago.

Freer Gallery of Art
Female Imagery in Indian Painting (through August 4) Paintings from the 15th and 19th centuries include images of a princess, the Hindu goddess Kali and the Virgin Mary.

Arthur M. Sackler Gallery
Preserving Ancient Statues from Jordan (July 28-April 6, 1997) Exhibition features ancient plaster statues (c. 7000 B.C.) from an ongoing excavation in Jordan.

National Museum of African Art
Crowning Achievements: African Arts of Dressing the Head (through August 18) Traditional and contemporary hats, headdresses and hairstyles.
Seydou Keita, Photographer: Portraits from Bamako, Mali (1950-1960) (through July 28) Evocative portraits.

Hirshhorn Museum & Sculpture Garden
Directions—Byron Kim: Grey-Green (July 18-October 20) Paintings by the New York-based artist from recent series inspired by Korean green-glaze pottery.

National Portrait Gallery
Louis Armstrong—A Cultural Legacy (July 26-October 27) Exhibition traces the life of the renowned jazz musician.

National Museum of American Art
Thomas Wilmer Dewing: Beauty Reconfigured (July 19-October 14) Exhibition looks at the work of one of the most important artists of the Gilded Age.

Renwick Gallery
American Crafts: The Nation's Collection (runs indefinitely) A selection of objects from the permanent collection.

Anacostia Museum
English and French Caribbean Music in Washington, D.C. (through August 11) The development of Washington's Caribbean music community.

S. Dillon Ripley Center, International Gallery
Artists at Work: A Smithsonian Celebration of Staff Creativity (through August 11) Exhibition of staff artwork.
Rotunda Gallery
Picturing Natural History (through August 25) Works by members of the Guild of Natural Science Illustrators.

Heye Center, National Museum of the American Indian (New York)
Partial Recall: Photographs of Native North Americans (through July 21) Exhibition examines the relationship between photography and identity.

Cooper-Hewitt, National Design Museum (New York)
Gallery Closing The exhibition galleries are closed through September 16.

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Highlights Continued

A visual remembrance

The 1930s and '40s bore witness to the Great Depression, the New Deal, the era of Jim Crow laws, the Great Migration and World War II. During these decades, black photographers such as Gordon Parks, Morgan and Marvin Smith, Robert McNeill and the Scurlock family produced a telling portrait of black neighborhoods and the world in which African-Americans worked, entertained and lived. These images testify to the rich community life that flourished despite the restrictions of a segregated society. Collectively they compose a comprehensive record of African-American life during a period of profound change. Some 300 of these works are on view through September 29 at the Arts and Industries Building in "Visual Journal: Harlem and D.C. in the Thirties and Forties." Presented by the Smithsonian's Center for African American History and Culture, the exhibition celebrates the individual vision of these photographers and offers an eloquent visual remembrance.

"In New York City's Harlem, and Washington, D.C., photojournalists and photography studios recorded and reinforced their communities' common culture," says the show's curator, Deborah Willis. The Scurlocks and Robert McNeill on "U" Street; the Smiths on 125th Street, Gordon Parks in the District, working for the Farm Security Administration (FSA)—all chronicled the multifaceted mosaic that comprised the African-American experience. An old peanut vendor plies his trade, Ella Fitzgerald sings at the Savoy, Girl Scouts tend a fire, elegant crowds flock to the Howard Theatre, a government charwoman brandishes mop and broom in front of an American flag. There are picnics and sports events, baptisms and birthdays, cotillions and conventions; images of protest and pageantry, celebration and sorrow, achievement and despair.

"Photographers are visual storytellers," says Willis. "They illustrate our place in society, document our dreams and preserve powerful memories."
Diane M. Bolz

Gordon Parks produced a penetrating series of photographs for the FSA in the early 1940s; here, Mrs. Ella Watson, a government charwoman, with her three grandchildren and adopted daughter.

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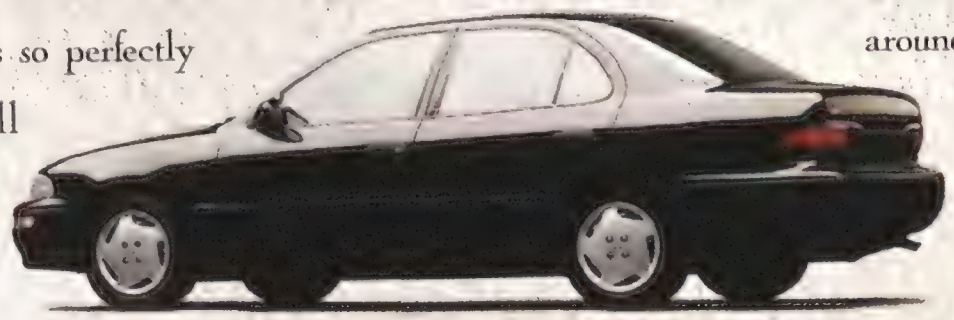

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By Jon Krakauer

Geologists worry about dangers of living 'under the volcano'

The experts believe Mount Rainier will give plenty of notice before it erupts again—the problem is that it can kill in other ways

Fourteen thousand four hundred and ten feet above sea level, I have to pause for breath between each plodding step as I arrive at the crest of Mount Rainier, the highest point in the Cascade Range. I've climbed this huge volcano many times over the past 30 years—for fun, for exercise, for escape from the urban grind. On this occasion, however, the impetus is morbid curiosity.

Recent geological reports have suggested that Rainier poses a serious threat to thousands of people who live in the shadow of the mountain—as I do—even if it does not erupt. My hope is that this ascent will shed a little light on the matter. It took two exhausting days to reach the top. Now, a caustic wind is screaming across the summit crater, flash-freezing the skin on my face and turning my mittened hands into blocks of ice.

Before my eyes is a chunk of country that stretches from Canada to central Oregon, some 200 miles away. Scanning the craggy spine of the Cascades, one can't help noticing that this corner of the planet is lousy with volcanoes: from my lofty vantage I count no fewer than nine of them. The most riveting—and most notorious—is Mount St. Helens, whose truncated cone squats immediately to the southwest. At the moment, its yawning crater is belching a plume of steam high into the troposphere, a gentle admonition that St. Helens—along with some two dozen other Cascade peaks—is very much an active volcano.

On Sunday, May 18, 1980, shortly before 9 in the morning, I happened to look up from a salmon net I was mending outside Tacoma, Washington, and saw what appeared to be a massive cumulonimbus cloud boiling toward the heavens, where a moment earlier there had been nothing but blue sky. Unbeknownst to me, avalanches had carried millions of tons of rock and ice off the top of Mount St. Helens, in essence suddenly removing the cap that had enabled the mountain to contain the molten rock and the superheated steam within. The resulting explosion obliterated what the avalanches had left of the upper 1,300 feet of the volcano and sent it hurtling into the sky.

The blast devastated plant and animal life for 150 square miles. The cloud of ash that caught my eye soared to a height of more than 60,000 feet, turning day to night across much of Washington, and scattered 540 million tons of volcanic debris across the Western United States. Fifty-seven people were killed, a remarkably small number considering the violence of the eruption. The death toll was so low due to evacuation measures, and because the mountain's rugged environs were sparsely populated and largely undeveloped.

Fifteen years later, as I mull the scenery from atop Mount Rainier, the merest glance between my boots suggests that the consequences could be much more dire when it's this peak's turn to blow. Hard to the northwest sprawl Tacoma, Seattle and their myriad suburbs. I can plainly make out the Space Needle, skyscrapers and 747s landing at Sea-Tac Airport.

Given that Rainier has erupted numerous times in the past (most recently, just 150 years ago), the proximity of so much humanity is troubling. Geologists warn that there is no way of knowing when the mountain will blow again—it could go off in 10 years or not for 10,000—but blow it will, eventually.

Hunkered on the crest of Rainier, watching freighters and ferryboats ply the dazzling waters of Puget Sound, it's easy to imagine that the volcano is ready to erupt at any moment. The rim of the summit crater is riddled with fumaroles actively venting hot gases from the bowels of the earth, filling my nostrils with their sulfurous stink. Even though the air temperature is well below freezing and most of the rest of the mountain wears a carapace of glacial ice hundreds of feet thick, the rocky ground beneath me is utterly bare of snow and disturbingly warm to the touch. Scientists have recorded

Ice-capped Mount Rainier, an active volcano, looms over Tacoma, Washington, and Puget Sound.

surface temperatures on the crater rim as high as 176 degrees F. The heat I feel through my insulated trousers makes it impossible to forget that somewhere not too far below lies a reservoir of fidgety, red-hot magma, itching to elbow its way to daylight.

Sixty miles north of Rainier, in a cluttered, windowless room on the University of Washington campus, banks of humming machines keep close tabs on the mountain's every seismological twitch, lest an eruption take the region by surprise. Antennas on the roof of the building gather signals from some 30 remote-sensing devices on or near various Cascade volcanoes: telephones and microwaves carry signals from 120 more. Twelve devices monitor Rainier. Tremors large and small show up as squiggly lines on an array of rotating drum graphs in the center of the room.

Ash and debris billowed from the truncated cone of Mount St. Helens two months after the 1980 eruption.

"Actually," confesses Steve Malone, a cheerful, bearded geophysicist attired in shorts and sandals, who oversees the seismology lab—"the drums provide some useful data, but they are mostly for the benefit of news media. They give TV crews something to point their cameras at whenever there's an earthquake. Here at the lab, we glance at the drums now and then, but mostly we rely on a fairly sophisticated computer system." Should any remote sensor record a seismic event of a magnitude greater than 2.4, the computers are programmed to trigger a beeper that Malone wears on his belt. Additionally, if the event is stronger than 2.9, the system will automatically send out a flurry of faxes and e-mail communiqués to scientists and emergency-management agencies throughout the region.

The big St. Helens blast in 1980 was preceded by a series of minor earthquakes prompted by movement of magma up the throat of the volcano; similar tremors would almost certainly give geologists plenty of notice before Mount Rainier next erupts. "With this system in place," Malone concurs, "the available seismic data should give us warning of an impending eruption weeks or even months in advance."

Truth be told, Malone doesn't think Rainier is a very likely candidate for an explosive, St. Helens-like eruption, in any case. Extrapolating from past eruptions, he and most other volcanologists believe that when Rainier blows its lid, it is apt to do so in a much less histrionic fashion, producing relatively modest explosions or extrusions of lava rather than a cataclysmic detonation.

Malone cautions, nevertheless, that it would be a grave mistake to conclude thereby that the mountain presents no great threat: "In fact, Rainier is perhaps far more dangerous than St. Helens. The frightening thing about Rainier is the hazard posed by catastrophic debris flows—a hazard most people aren't even aware of." Known to geologists as lahars (an Indonesian term), such flows are flash floods of semiliquid mud, rock and ice that surge down from the heights with terrifying speed and destructive power.

"Lahars have occurred throughout Rainier's history," warns Malone, "and they can happen more or less spontaneously, in the complete absence of an eruptive event, with practically no warning at all. Horribly, we remember what happened to Armero, and worry that something similar might happen around here."

Armero was a prosperous farming community nestled in the Andes in Colombia, not far from Bogotá. On the evening of November 13, 1985, residents of the town felt the earth tremble and heard a series of rumbling explosions emanating from a 17,453-foot volcano called Nevado del Ruiz, 30 miles away. According to a local woman named Marina Franco de Huez, an ominous cloud rose from the mountain's crater, raining ash down on Armero, "but we were told it wasn't anything serious."

Armero, Colombia, lies buried after a slurry of mud and debris from a volcano swept over it in 1985, killing 23,000. Rescue workers did what they could.

Although the volcano was erupting, at first there seemed to be little reason for concern. Indeed, newspaper reports later described the event as a "relatively small eruption, a volcanic burp" that melted only about 5 percent of the ice and snow covering the uppermost reaches of the peak. The "burp" was sufficiently powerful, however, to collapse a steep buttress below the summit crater, initiating an avalanche of rock, snow and ice—a classic lahar—that swept down the slopes of Nevado del Ruiz from an elevation of 15,000 feet.

Liquefying and gathering momentum as it rocketed down a river drainage toward the valley bottom, the lahar wiped out a natural dam, sending a colossal mud slide downvalley. As one resident of Armero remembered the ensuing cataclysm, "I heard a sound like a huge locomotive going at full steam, and then I felt water swirling around my neck."

Within moments, the town was inundated with a slurry resembling wet concrete, burying the community beneath 30 feet of gray-brown muck. The next morning, where their homes had once stood, survivors gazed upon a stark, lunar-like plain covering 600 acres and lit-

tered with smashed cars, corpses and uprooted trees. An estimated 23,000 people lost their lives, and more than 60,000 were left homeless. It was the worst natural disaster in Colombia's history.

Kevin Scott (below), a senior geologist at the U.S. Geological Survey's Cascades Volcano Observatory in Vancouver, Washington, warns that there are a number of disquieting parallels between Nevado del Ruiz and Mount Rainier. As he tells me this, he is standing in a field beside a new housing development in Orting, a rapidly growing town in the lowlands near Puget Sound. "The Mountain" (as Rainier is known locally), gleaming in the summer sun, looms to the southeast less than 30 miles away.

Living on top of an old lahar

A solitary block of lava as big as a Volkswagen Beetle rests incongruously on a manicured sward behind a recently constructed house. "You know how that boulder got here?" Scott asks. "It was carried down from Rainier by a lahar. This development, like most of the rest of Orting, was built on 20 feet of debris deposited by the Electron Mudflow, a lahar that came down the Puyallup River Valley about 500 years ago." The geologic record indicates that at least 60 major lahars have roared down from Rainier over the past 10,000 years; a few of them ran all the way to Puget Sound, more than 50 miles from the mountain.

Scott points out that Armero, like Orting, was built on debris from an old lahar: "Armero had already been destroyed at least once, in 1845, before the most recent disaster—by a mudflow that killed hundreds of people. Yet the town was rebuilt in the same place. We can be fairly certain that sooner or later another lahar is going to plow through Orting, too—we just don't know when.

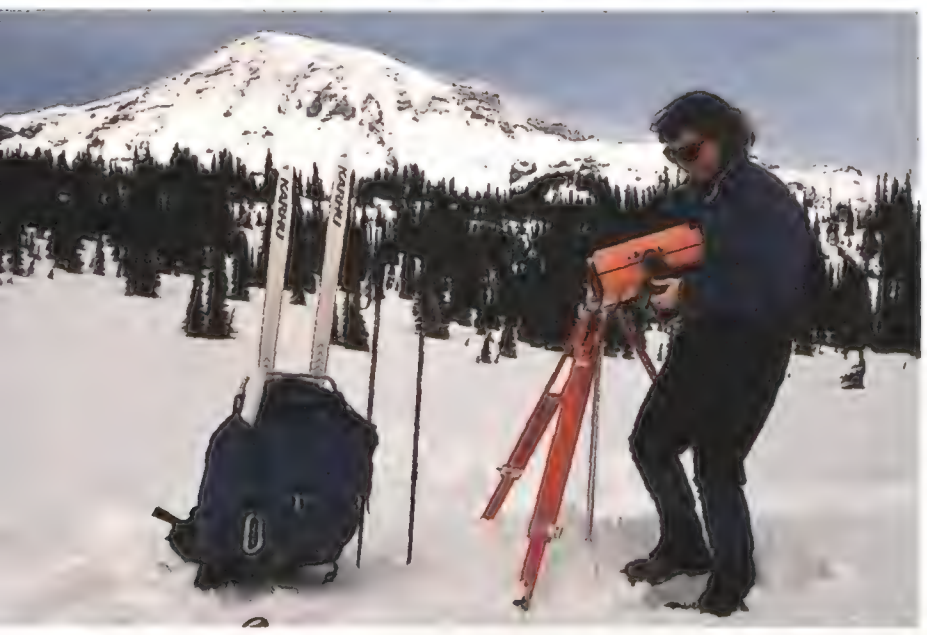
"Judging from the frequency of mudflows on Rainier in the past, we are reasonably confident that the recurrence interval for major lahars is between 500 and 1,000 years. That sounds like an awfully long time, long enough that we don't really need to worry. Statistically, however, it's been calculated that a house built on the floodplain of a lahar is many times more likely to be destroyed by a lahar than by fire. Almost nobody would consider owning a home without fire insurance and smoke alarms, yet people think nothing of living in the path of mudflows without safeguards. Most folks simply don't take the risk of lahars seriously."

Geologists take lahars very seriously, which is why Mount Rainier makes them so nervous. More than 100,000 people live in homes built on debris washed down by lahars. Two hundred thousand Puget Sound residents go to work each day at businesses lying in the path of documented mudflows. A report published in 1994 by the National Research Council warns, "This

Geologist Kevin Scott sits on stump of tree killed by debris flow 500 years ago in Orting, Washington (top).

metropolitan area is the high-technology industrial center of the Pacific Northwest and one of the commercial aircraft manufacturing centers of the United States. . . . A major volcanic eruption or debris flow could kill thousands of residents and cripple the economy."

Lahars are a hazard of virtually all volcanoes, but Rainier has some unique geologic traits that make it especially dangerous. Thanks to its great height and the sodden Northwest climate, Rainier wears a stupendously robust mantle of ice. Twenty-six named glaciers drape



Carolyn Driedger, a hydrologist, prepares to pinpoint location of instrument that measures glacial ice depth.

Rainier's broad flanks, a reservoir of snow and ice approximately equal to that of all the other Cascade volcanoes combined. The melting of just a tiny fraction of this frozen water during a volcanic event could unleash lahars of biblical proportions.

"Compared to any other volcano in the Cascades," Scott declares, "Rainier is in a class by itself in terms of risk to human life and property."

"Rainier is covered with 36 square miles of perennial snow and ice," muses Carolyn Driedger (above), a hydrologist with the Cascades Volcano Observatory who has carefully measured the size and thickness of the mountain's glaciers. During the eruption of Mount St. Helens, she says, three-quarters of that volcano's glacial ice melted over a very short time, creating gargantuan mudflows that ran all the way to the Columbia River, filling its channels with enough debris to disrupt international shipping for three months. "And remember that St. Helens," Driedger points out, "only had about 4 percent as much year-round ice and snow as Rainier has. That's pretty sobering to think about."

Stewing in its own juice

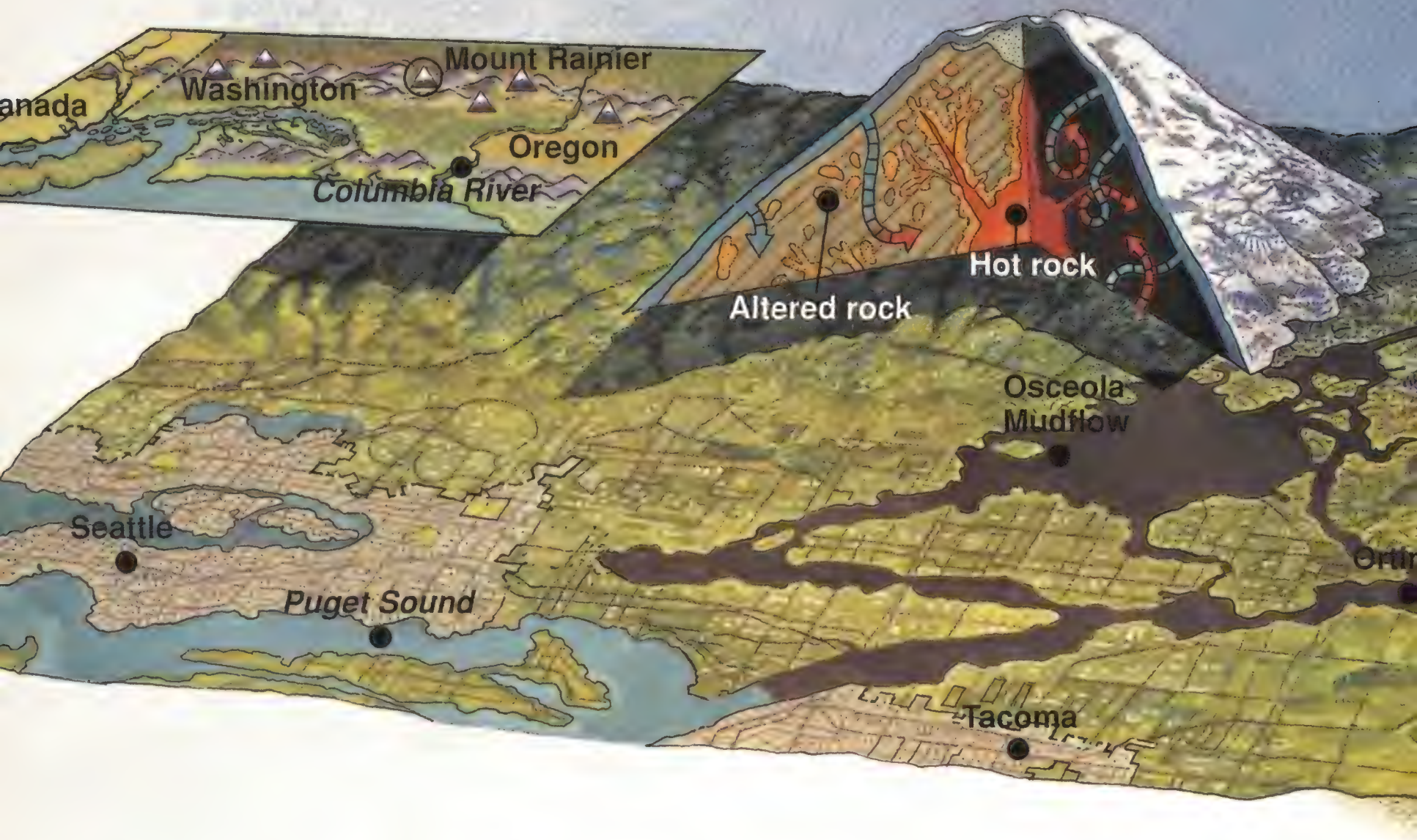
Rainier's prodigious mantle of ice contributes to the potential danger in a less obvious, more insidious way, as well. The peak's subterranean heat is continuously melting its glaciers from below, feeding water into a complex system of geothermal aquifers. Constantly circulating through the mountain, this abundance of hot liquid combines with sulfur-bearing gases to produce acids that are eroding Rainier from the inside out, undermining its structural integrity. "The entire edifice of the mountain is stewing in its own hot chemical juices," explains Scott, "and as a consequence it's becoming increasingly rotten and unstable."

Geologists, who call this phenomenon hydrothermal alteration, have only recently begun to appreciate its impact on Mount Rainier. "We don't have a very complete picture of what's going on up there yet," says Don Swanson, a geologist with the U.S. Geological Survey and a contributor to the 1994 National Research Council report. "But the hydrothermal alteration of all that rock is alarming to contemplate. I firmly believe that learning the extent of the alteration is among the most important things to find out about Rainier."

Most of what we know thus far comes from the efforts of Tom Sisson and David Zimbelman, geologists who have spent many months on the mountain, painstakingly studying and mapping it. "It's extremely hard work," Zimbelman admits. Because altered rock is inherently unstable, he and Sisson had to climb some of Rainier's more dangerous slopes to conduct their research.

The research has shed considerable light on the degree to which strong acids percolating through Rainier's innards are transforming solid rock into soft, crumbly clay, a process that is readily apparent on the rim of the summit crater. The thin air up here reeks of rotten eggs: the telltale scent of hydrogen sulfide gas, which condenses and mixes with water to form sulfuric acid, the primary agent of alteration on Rainier. Around the steaming summit fumaroles, clumps of reddish brown mud cling to the spikes of climbers' crampons. This spongy stuff is hydrothermally altered rock.

Zimbelman and Sisson have discovered bands of



Mount Rainier (in cutaway, above, and opposite) has 25 times as much ice as Mount St. Helens did. It can cause catastrophic debris slides known as lahars, which in the past have reached Puget Sound. The cutaway shows how infiltrating water is heated; it melts glacier bottoms and, with hydrogen sulfide added, turns rock to clay.

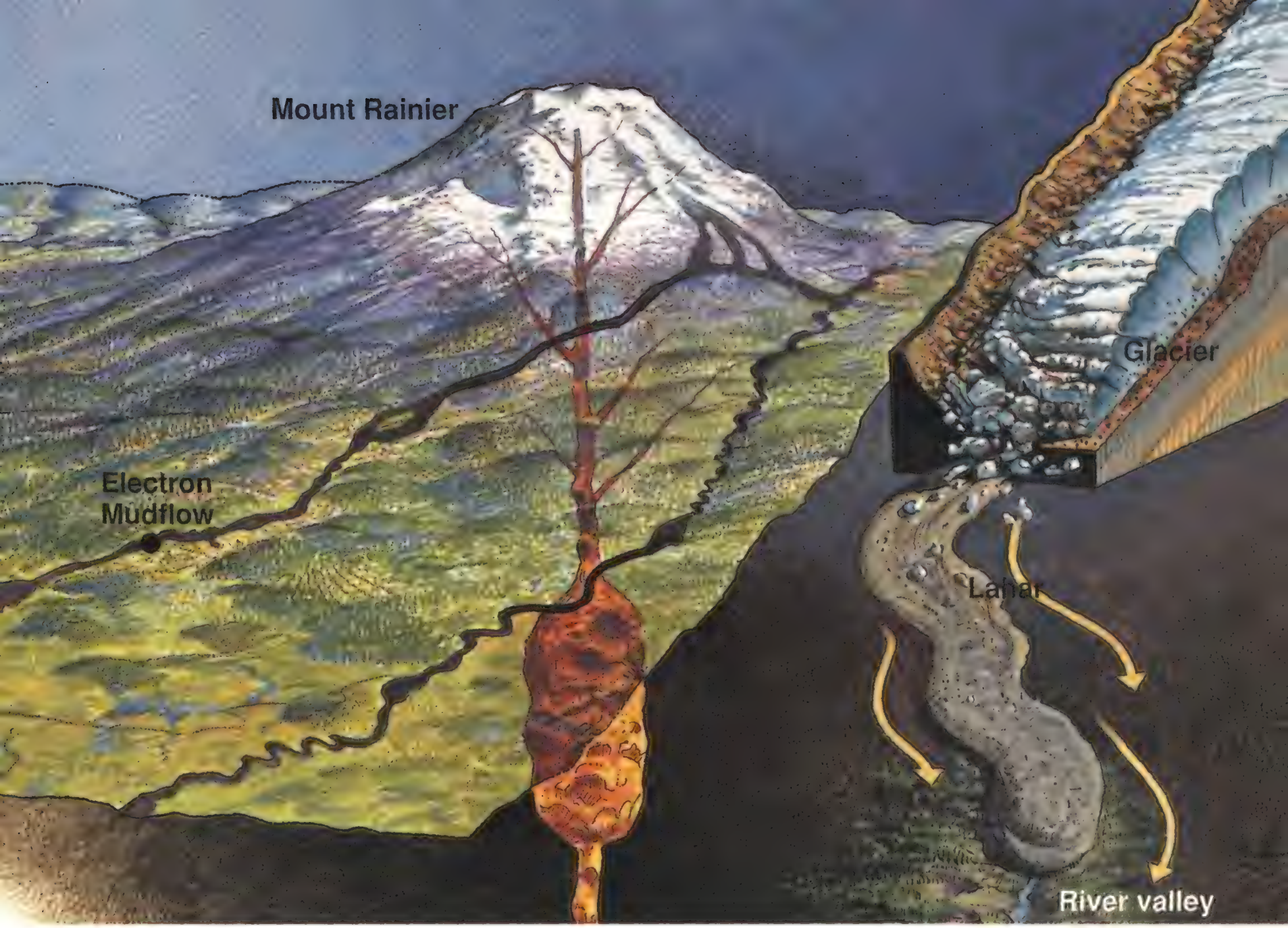
weak, highly altered rock that locally penetrate the mountain. It is the nature of clay to absorb water, and expand when it does so. As zones of newly altered rock on Rainier swell with moisture, dry out and re-expand, the clay acts as a sort of natural crowbar, prying apart the more solid rock around it, further weakening the edifice.

As soon as part of Rainier grows sufficiently rickety, a catastrophic lahar is bound to result. "What would it take to trigger a significant mudflow?" asks Zimbelman. "Certainly an earthquake could do the job. But so could a much lesser event like a minor steam explosion. You have all this gravitationally unstable rock becoming weaker and weaker; eventually it's going to reach a point where it won't take much of a jolt to break off a big piece of mountain and send it tumbling toward Puget Sound. In fact, you could have a major sector collapse without any triggering mechanism at all. That's what's so scary: something huge could come down simply under its own weight, with no advance warning."

When Rainier is viewed from southern Puget Sound, it looks like a large part of the summit cone is missing, as though removed by some Brobdingnagian ice-cream scoop. The cliffs that form the walls of the hollow are mottled with yellowish orange splotches: zones of rotten, clay-rich altered rock that hold clues to what happened here. The scooped-out area is called the Sunset Amphitheater, and its existence hints at what can happen when a really big piece of the mountain lets go. The hollow is where the Electron Mudflow started.

Around the corner from the Sunset Amphitheater, on the north face of the mountain, scars from an even bigger cataclysm are visible with the naked eye from downtown Seattle. They were left behind by the Osceola Mudflow, the largest known lahar ever spawned by Mount Rainier. It came thundering down about 5,000 years ago, when something—perhaps an earthquake or a buildup of steam within the volcano, perhaps nothing more than the tug of gravity on hydrothermally weakened rock—caused the upper 2,000 feet of the peak to cleave off and slide away. A dusting of airborne ash sprinkled over the region at the time of the mudflow indicates that it was accompanied by a modest volcanic eruption, but many geologists have come to believe that the landslide may have triggered the eruption, rather than vice versa.

The Osceola Mudflow began as an avalanche of mind-



boggling size, carrying 60 times as much rubble as the lahar that wiped out Armero in 1985. Much of the flow consisted of clay saturated with geothermal fluids, an avalanche of semiliquid muck that roared downslope at a speed in excess of 100 miles per hour.

As it reached the base of the mountain and churned down the valleys of the White, Green and Puyallup rivers, the lahar slowed to between 30 and 50 miles per hour, but it nevertheless scoured the earth of everything in its path. Thanks to its high clay content, the Osceola Mudflow was what geologists call a cohesive lahar: a thick, gooey mass viscous enough to suspend house-size boulders and 200-foot trees within its flow. Indeed, it swallowed up entire forests and carried them down onto the plains below.

Cohesive lahars tend to travel farther and pack a greater punch than more dilute, clay-poor, noncohesive lahars, and the Osceola Mudflow was no exception. It ran all the way to Puget Sound, whose shores lay considerably east of where they do now. The lahar blanketed at least 200 square miles with a layer of concrete-like muck that averaged 25 feet deep, burying the sites of present-day Orting, Enumclaw, Auburn, Puyallup, Kent, Sumner and some of the Tacoma waterfront.

If a similar lahar came down Rainier tomorrow, it would take about one to two hours to reach the densely populated lowlands. According to Kevin Scott, residents of Orting would see "a wall of trees, rocks, and mud rolling down the canyon of the Carbon River at perhaps 30 miles per hour. The sound would be deafening and the earth would tremble. In Armero, survivors reported hearing a loud roar and feeling the ground shake when the lahar was still five kilometers away, but they didn't know what was happening—they thought it was an earthquake—they didn't run to high ground."

Hoping to avoid such deadly confusion, in February of last year the Orting Fire Department hand-delivered copies of an emergency evacuation plan to each of the town's roughly 3,000 residents. The plan explains that if a debris flow is expected, sirens will sound throughout Orting, indicating that people should immediately leave town via evacuation routes described on an attached

Jon Krakauer, a climber and a frequent contributor, reached the top of Mount Everest in May. Four members of his party were lost on the way down.

Geologist Tom Sisson examines lava rubble. The jagged rock above him is from a relatively recent eruption.

map. In conjunction with the plan, the local schools regularly practice lahar evacuation drills.

"The last time the schools held a drill," says Orting Fire Chief Scott Fielding, "all the kids were out of the city and bused to high ground in 15 minutes. I'm more concerned about our adult citizens. We've told them, 'When you hear the sirens, get in your car and leave! Immediately!' But adults are more likely to doubt the seriousness of the situation, to question it, to fool around. Realistically, I doubt we'd get more than 50 or 60 percent of the people to actually evacuate."

Fielding acknowledges that for the evacuation plan to work at all, moreover, the town will have to have some advance warning that the mud is bearing down. "And at present," he laments, "no early-detection system is in place. If someone up toward the mountain doesn't happen to see the debris flow and phone the fire department, it's going to be bad news for the people downstream. Personally, I live on a hill above town, so I sleep well at night. But I worry about my friends who live on the valley floor."

Scientists and government officials have discussed establishing a network of electronic sensing devices in each of the threatened drainages to sound a warning when a lahar is on the way. Such a system, however, would probably be far from foolproof. "The technology for implementing something like that would be pretty straightforward," says Steve Malone. "The problem will be maintaining it in the long term, and getting people to take it seriously when the alarm goes off after decades or even centuries without anything happening."

What, then, can we who live in the shadow of the mountain do to protect our lives and property the next time a tsunami of mud comes rumbling down from the heights? Civil engineers have suggested constructing massive containment dams in each of the half-dozen river drainages that snake down from Rainier to Puget Sound. Such structures could be designed to catch most of the sediment released by a lahar.

Although containment dams would probably stop a lahar, says Patrick Pringle, a geologist with the Washington State Department of Natural Resources, "the cost of building and maintaining them would be substantial, and I don't think the public is willing to commit those kinds of funds in this economic climate. It's hard to galvanize people to do anything until after a disaster has already happened. Mudflows occur so infrequently that people would rather just take their chances. They'd rather spend their tax money on a new baseball stadium. Such dams would also pose environmental problems."

In the absence of containment dams and a reliable early-warning program, an obvious way to reduce the risk would be to enact zoning laws that would prevent people from building homes or businesses in the path of documented mudflows. "But most of the land we're talking about is prime real estate," laments Don Swanson. "It's probably unrealistic to think that very much of it will be placed off-limits."

Given fiscal and political realities, Swanson, Scott, Pringle and other experts believe the best course of action for the time being is to learn as much as possible about the hazards posed by the mountain and aggressively share that knowledge with the public. Toward that end, the International Association of Volcanology and Chemistry of the Earth's Interior has designated Rainier, along with 14 other mountains worldwide, a "Decade Volcano": an unusually dangerous volcano earmarked for intensive study.

"We're trying to come up with hard statistical data," says Pringle, "actual numbers people can use to get a handle on the risk. We want to give people enough knowledge to make rational decisions concerning their options. The challenge is to get the public's attention without alarming anybody unnecessarily."

"It's extremely hard to quantify these kinds of risks," Swanson concedes. "How do you put large but infrequent hazards into any sort of meaningful statistical context? A catastrophic mudflow is not likely to happen on Rainier in our lifetime. But it will happen somewhere down the road, in one or more generations—and when it does, a lot of people will lose everything."

The tranquillity of monkey flowers and a clear lake belie the potential threat of ice-clad Mount Rainier.

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By Paul Trachtman

When Cubism met the decorative arts in France

From side tables to the dazzling dress designs of Sonia Delaunay, a new exhibition at the Portland Museum in Maine surveys the scene

Robert and Maurine Rothschild Collection

Two Women (opposite), painted by Fernand Léger in 1922, and other Cubist works inspired French designers. Sonia Delaunay's bold dresses from the mid-1920s (above) were snapped up by the likes of Gloria Swanson.

"When we invented Cubism, we had no intention whatsoever of inventing Cubism," said Pablo Picasso, many years later. "We wanted simply to express what was in us." What was in Picasso and his contemporaries was a voracious, if not violent, appetite for new forms of intellectual, cultural and industrial life that were shaping a nascent 20th century. The decorative and flowing Art Nouveau, along with the vibrant and emotional expressiveness of the Impressionist painters—a last flowering of 19th-century Romanticism—was cast aside for the new ideas of Freud and Einstein, stripping bare the human psyche and the physical universe. When a prominent collector objected to Picasso's use of house paint in some 1912 paintings, the artist told his Paris dealer, "Perhaps we shall succeed in disgusting everyone, and we haven't said everything yet."

At first, there wasn't much of a public to disgust. Early critical responses to the new Cubist art ranged from "ugly" to "grotesque," but only a few people actually looked at it, even in Paris. Gertrude Stein, an American writer in Paris who was doing away with grammar as Picasso did away with perspective and anatomy, recorded the young painter's ire at his critics: "Picasso said to me once with a good deal of bitterness, they say I can draw better than Raphael and probably they are right, perhaps I do draw better but if I can draw as well as Raphael

I have at least the right to choose my way and they should recognize it, that right, but no, they say no."

Yet, despite its early limited influence, the new style spread from the artists' studios to the salons and then into popular culture in a relatively short time. By the 1920s, about the same time that the Spanish philosopher José Ortega y Gasset was declaring modern art "antipopular" and predicting that it "will always have the masses against it," a modern geometric style of decorative arts, drawn partly from Cubism, was inspiring French designers of clothing, furniture, lamps, clocks, dinnerware, even architecture. By the mid-1920s, the new Art Deco style had spread into almost every aspect of popular life. Its influence would soon be seen in the United States as well, in the sleek geometric facades of movie palaces, roadside diners and gas stations, and the stripped-down fashions of the flapper era. By 1925, when an international exposition of decorative and industrial arts was staged in Paris, a critic could see Cubism's influence in epochal terms, writing: "With the Exposition des Arts Décoratifs a new style is established to take its place with the historic periods. To the Renaissance, the Jacobean, the Georgian, the Rococo and the Colonial is added the Modern."

The popularity of Cubism in the decorative arts caught the attention of Kenneth Wayne, a young curator at the Portland Museum of Art in Maine, who went on to organize the museum's current show "Picasso, Braque, Léger and the Cubist Spirit, 1919-1939," which runs through October 20. One part of the show sets the objects of Art Deco design alongside paintings and sculptures of the Cubists from the years between the two world wars. And in doing so, it offers a rare chance to see the Cubists from a different angle, a fresh perspective.

Claude Bernès Collection

The first Cubist brushstrokes appeared in Picasso's historic painting *Les Demoiselles d'Avignon*, made in 1907. A composition that combines elements of realism, primitive form and geometric abstraction, it depicts five nude figures gathered around a small arrangement of fruits. It was not yet Cubism but certainly pointed the way with faces inspired by African masks or broken down into geometric forms, with breasts and torsos represented by diamonds, rectangles and triangles along with more natural orbs and curves. Perspective was diminished in the flat planes of the painting, and the background fractured, as if the scene were reflected in a broken mirror. What was indeed reflected in this painting was the legacy of Paul Cézanne (SMITHSONIAN, April 1996), his flattened landscapes and still lifes expressing the elemental forms and planes of nature.

Georges Braque met Picasso around this time, and in 1909 they began a collaboration that could be called the invention of Cubism. Henri Matisse, seeing some Braques the year before, rather scornfully coined the term "Cubism." For the next few years, Braque and Picasso maintained a close but private relationship, showing each other their new paintings and constructions. These works were part of their visual dialogue, and it was often hard to tell which artist painted which. They rarely exhibited in the Paris salons, but other artists, visiting their studios and glimpsing their work, were converted to the new style.

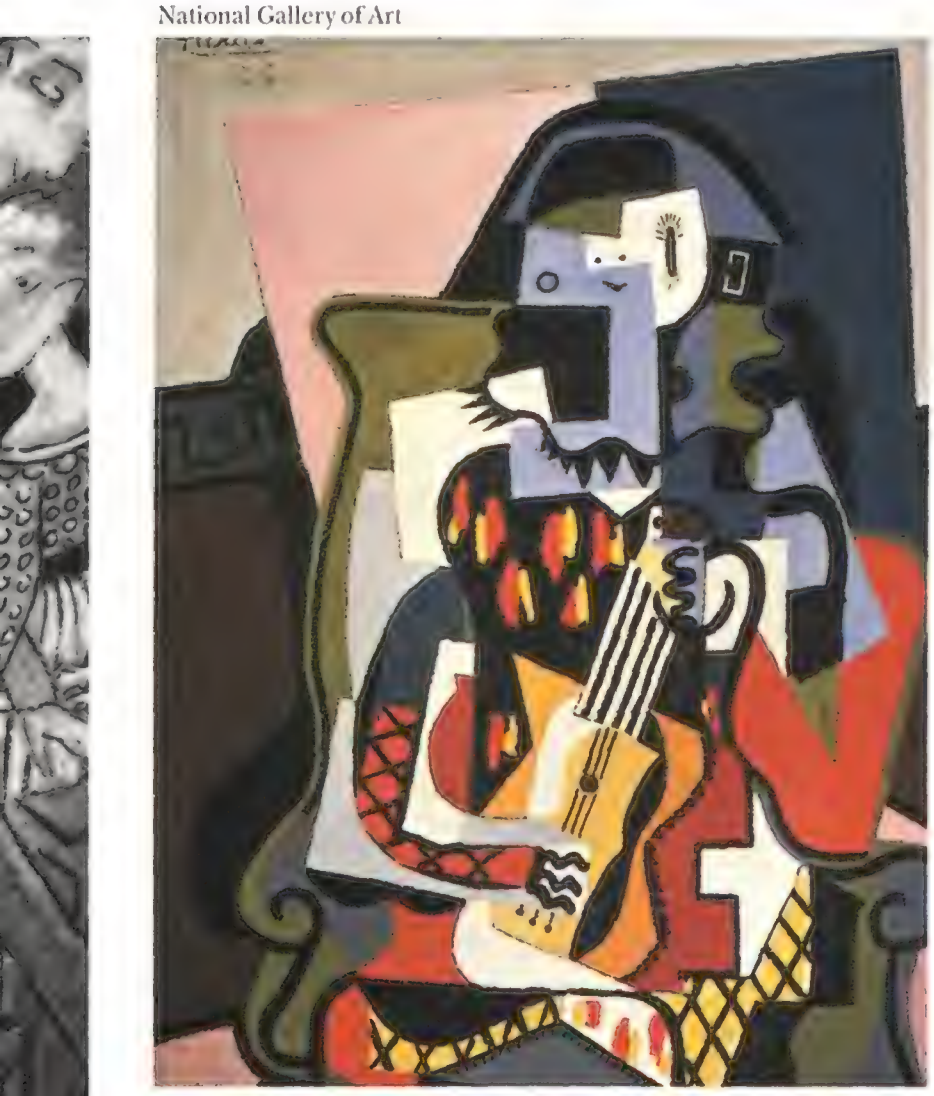
Fernand Léger, fascinated with the machines and designs of industrial society, found in Cubism an ideal technique to express his own vision of modern life. Juan Gris, more intrigued with the landscape of his own mind than the outer world, gave Cubism its purest, most mathematical form, using a compass and ruler to plot out his paintings. Others, including Matisse and the young Mexican painter Diego Rivera, who came to Paris in 1912, had brief flirtations with the Cubist style. The sculptor Jacques Lipchitz cast Cubist images in bronze. "What began as a rarefied pictorial style," says Kenneth Wayne, "became a popular language." To understand this language, it helps to clear away the layers of interpretation that have been added over the years. "Mathematics, trigonometry, chemistry, psychoanalysis, music and whatnot have been related to Cubism to give it an easier interpretation," Picasso once complained. "All this has been pure literature, not to say nonsense, which brought bad results, blinding people with theories."

The show Wayne has put together includes more than 100 paintings, sculptures, prints and decorative objects made in the two decades after World War I, when Picasso and Braque emerged from their hermetic, prewar collaborations into a Cubism that could delight the senses. Among the paintings in the show one finds two Braque still lifes with a bright, decorative air: his *Pipe and Basket* of 1919 and 1927's *Still Life with Pears, Lemons and Almonds* (p. 51). The later work seems an almost playful throwback to the still lifes of Cézanne, with the table slightly tilted and everything just about to slip off. There is also Picasso's *Harlequin Musician* of 1924 (left), a vibrant play of form and color in a figure that may represent the artist himself. "Picasso identified with the harlequin figure," one critic observed, "because it's an entertainer, a trickster, a figure on the fringes of society, and that's how he saw himself."

One of the most striking paintings in the show is Fernand Léger's *Two Women*, made in 1922 when the artist turned to human rather than purely industrial forms in the hope of coming closer to life, albeit life with a metallic sheen. He was seeking a Cubism the working class could understand, his wife recalled.

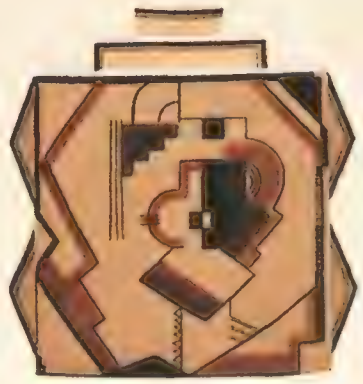
The decorative objects in the show are displayed in two large alcoves, where one can clearly see the influence of

National Gallery of Art



Left: With food scarce during the war, artists often ate at Marie Vassilieff's canteen, furnished with flea-market furniture. Here, in Vassilieff's 1917 drawing, Braque (wearing laurel wreath) is feted after discharge from the army. Picasso, in a suit, sits opposite; Matisse holds turkey; Modigliani, at door, crashes the party. Above: *Harlequin Musician* (1924) by Picasso may be a self-portrait.

Cubist-inspired works of decorative art in the show at Maine's Portland Museum include, clockwise from right: Robert Lallemant's ceramic vase; lacquered-wood folding screen by Jean Dunand; aluminum-and-plastic desk lamp designed by Jacques Le Chevallier; and side tables by Pierre Chareau. All of them date from the late 1920s.



the artists on popular style and fashion. A vivid example of this influence is the ceramic vase made by Robert Lallemant in the late '20s; its jagged edges and geometric motifs use the same Cubist vocabulary as the canvases on the walls near it. A folding screen by decorator Jean Dunand and a pair of side tables by Pierre Chareau exhibit a Cubist play of planes, as if blurring the distinction between flat and three-dimensional space.

The bold, geometric clothing designs of Sonia Delaunay, a painter who once collaborated on fashions with Coco Chanel, are another highlight of the Portland Museum show. Delaunay, like Picasso, designed costumes for Diaghilev's avant-garde Ballet Russes, but her successes in the world of textiles and fashion took Cubism off the stage and into the streets, ready to wear.

Her dresses first appeared in Paris just before the war, in 1913-14, when she wore them to the Bal Bullier, a popular dance hall where artists and poets tried out new dances like the fox-trot and the tango. Delaunay's dresses were made from geometric scraps of various fabrics, combining taffeta and tulle, flannel and silk, in bright, contrasting colors, from violet and green to scarlet and blue. She dressed her husband, Robert, also a painter, with similar style. One account describes him as wearing "a red coat with blue collar, a green jacket, sky-blue waistcoat, a tiny red tie, black pants, red socks, black-and-yellow shoes." By the war's end, Delaunay could sell her designs from her own Paris boutique and attract such famous customers as the Hollywood actress Gloria Swanson. By 1923 her geometric patterns were being printed by a French silk manufacturer. Soon after, her garments could be found in London and New York department stores.

The Portland show is significant not only for its content but for its location as well. Small and medium-sized museums around the country are becoming more important to our cultural life at a time when great blockbuster shows are ever more costly and difficult to mount. "There will always be the blockbusters," says Wayne, "but the smaller museums are doing interesting things that draw on their own strengths." Wayne arrived at the Portland Museum of Art only a year ago, fresh out

Clockwise from far left: Primavera Gallery, Norwest Corporation, Anthony DeLorenzo, Norwest Corporation

of Stanford graduate school, and was asked to organize a major exhibition for this summer. "I've been sprinting ever since," he says.

The show at the Portland Museum is an invitation to take another look at what the Cubists were up to. It was a sociable world where Cubists and other young artists rubbed shoulders. Picasso went horseback riding with Matisse; Modigliani sketched Picasso in a restaurant; and avant-garde writers, composers and painters all gathered together at cafés, salons and dinner tables.

Even the lines between fine art and the decorative arts were in question. Duchamp hung hardware on gallery walls. Sonia Delaunay made Cubist-inspired dresses. Le Corbusier painted still lifes and also designed houses, which he defined as machines for living in. Léger saw machines as objects of beauty.

The Cubists and their friends were taking their cues from their environment: from the landscape, the streets, the materials of everyday life. "When one crosses a landscape by automobile or express train, it becomes fragmented," Léger said. "A modern man registers a hundred times more sensory impressions than an eighteenth-century artist. . . . The compression of the modern picture, its variety, its breaking up of forms, are the result of all this." Painting, he declared, "has never been so truly realistic, so firmly attached to its own period as it is today." To claim realism for the geometric Cubist compositions may seem like a bit of avant-garde hyperbole, but Léger was being quite literal. "We live in a geometric world," he asserted. The Cubists were painting their experience of the world, a world in which "rupture and change crop up unexpectedly."

In its emphasis on geometric forms, Cubism was often mistaken as a rejection of nature and the landscape altogether. Ortega y Gasset described the modern painter as willfully blind to nature: "He shuts his eyes to the outer world and concentrates upon the subjective images in his own mind." But this is hardly what Léger or Picasso had in mind. On one of the rare occasions when he really spoke about his art, Picasso declared, "One cannot go against nature, it is stronger than the strongest man." Gertrude Stein recalled his bringing back some early Cubist paintings of a Spanish village after a trip to Spain in 1909: "Picasso had by chance taken some photographs of the village that he had painted and it always amused me when every one protested the fantasy of the pictures . . . [he wanted to show them] that the pictures were almost exactly like the photographs." It was as if Picasso saw Cubism out of one eye, reality with the other.

It was not the details but the emotions, the feeling of life and nature that Picasso was after. "The painter goes through states of fullness and evacuation," he said. "That is the whole secret of art. I go for a walk in the forest of Fontainebleau. I get 'green' indigestion. I must get rid of this sensation into a picture. Green rules it. A painter paints to unload himself of feelings and visions."

Léger sometimes seemed to doubt that he could ever paint with the vividness of the real machinery all around him. Once recalling a showing of his paintings at an annual Paris exhibition, the Salon d'Automne, he wrote: "I had the advantage of being next to the Aviation Show, which was about to open. I jumped over the barrier, and never had such a stark contrast assailed my eyes. I left vast surfaces, dismal and gray, pretentious in their frames, for beautiful, metallic objects, hard, permanent, and useful, in pure local colors; infinite varieties of steel surfaces at play next to vermilions and blues. The power of geometric forms dominated it all."

The vividness Léger found in the Aviation Show had its match in the life of the Paris avant-garde. Looking back, we tend to think of the Cubists only in terms of

Paul Trachtman's most recent SMITHSONIAN *article was about the computer artist Charles Csuri (February 1995). He writes from New Mexico.*

Baltimore Museum of Art

In *The Painter's Window,* Juan Gris portrayed palette and brush and other everyday items in the Cubist style.

their art, as though they were making their paintings in a vacuum. But they were living in an exciting milieu, and the artists and their lives often provided the raw material of Cubism. A few anecdotes, like old snapshots, give only a faded impression of the time: Gertrude Stein observed that Picasso often got new ideas from writers, not from other painters. Jean Cocteau was one of those writers. Soon after they met, Picasso asked Cocteau to pose for him. In turn, Cocteau invited Picasso to join him and the composer Erik Satie in collaborating on costumes and sets for the ballet *Parade.* "Picasso was the great encounter for me," Cocteau wrote of his visits to the painter's studio. "How my heart pounded as I hurried up those stairs." Marcel Duchamp, who made his second sale of a painting to the dancer Isadora Duncan, knew the writers, too. "The amusing thing about the literary people of that time," he recalled, "was that, when you met two authors, you couldn't get a word in edgewise. . . . One was torn between a sort of anguish and an insane laughter."

Like Gertrude Stein, the young American writer Ernest Hemingway was in Paris and became intrigued by the painters. Hemingway claimed that he studied the Cézannes at the Louvre to improve his writing style and said he could see Cubist images in the nightlife of a Paris street. There were no sewers, and at night tank wagons pumped out the cesspools of the old apartment buildings. "The tank wagons were painted brown and saffron color," he wrote, "and in the moonlight when they worked the rue Cardinal Lemoine their wheeled, horsedrawn cylinders looked like Braque paintings."

Cubism was not the only new art movement that flourished in this avant-garde hothouse. There were the Futurists, the Surrealists, the Dadaists, and there was Matisse who ignored them all. But it was Cubism that had the greatest impact on the popular mind, producing a new visual consciousness.

The Cubists' view of things became more understandable as the world was fractured by World War I. In fact, the war was a kind of alchemy through which a modern consciousness was formed from its elements. As the French mobilized, Gertrude Stein was with Picasso at a telling moment. "I very well remember at the beginning of the war being with Picasso on the boulevard Raspail when the first camouflaged truck passed," she wrote. "It was at night, we had heard of camouflage but we had not yet seen it and Picasso amazed looked at it and then cried out, yes it is we who made it, that is Cubism."

It wasn't only the camouflage that was Cubist. The French novelist Louis-Ferdinand Céline portrayed the war, as seen by a young soldier, in images a Cubist well might have painted. When Picasso described his pictures as "a sum of destructions," he was talking about esthetics, not war. "I do a picture—then I destroy it," he said. "In the end, though, nothing is lost: the red I took away from one place turns up somewhere else." But a Cubist esthetic that defined the creative process in terms of destructions seemed less strange after the shock of World War I. Céline's soldier, and many others, saw both armies as madmen "shut up on earth as if it were a looney bin, ready to demolish everything on it, Germany, France, whole continents, everything that breathes, destroy, destroy. . . ." As Gertrude Stein saw it, people "were forced by the war to recognize Cubism."

As the war ended, French designers did more than recognize it. They helped to popularize it. Their "capricious geometry" was set in concrete mansions, embodied in tubular steel furniture, printed onto wallpaper and textiles, even embroidered into women's shoes. One innovation of the Cubist painters, the arresting surface textures and odd materials in some of their canvases and collages, was seized on with gusto by the designers. Braque had painted still lifes with oils and sand on canvas, for example, and Picasso produced collages with dishcloth fabric, pins and nails. Then the designers rushed in, adding exciting new contrasts and materials as well as new forms to popular decor and fashion.

Sonia Delaunay's postwar couture sometimes combined fur, wool and silk. Le Corbusier introduced a

leather and metal chaise longue molded to fit the human body. Interior designer Marcel Guillemard dreamed up a Cubist cabinet and bar made of metal tubing and square panels stacked in pivoting sections that could swing out at various angles; it would fit right in with the plastic cubes and sectional furniture found in today's shopping malls. Others achieved their effects with new and sometimes improbable juxtapositions of materials. Jacques Le Chevallier designed a desk lamp of aluminum and plastic, cut into trapezoids and rectangles, with adjustable metal flaps for the shade. And Pierre Legrain's faceted, geometric clock was made of metal and sharkskin.

The Cubists kept on painting after the war, although heading in different directions. While Braque mostly stuck to his still lifes and Léger began to explore biomorphic forms, Picasso pursued several other styles along with Cubism, including Neoclassicism and Surrealism, and sometimes put them all into the same painting. By then the Cubist spirit was alive and well in the world, and the original Cubists knew that they had been seen, if not always understood. And that was what they were really after. When Picasso painted a portrait, for example, he wanted us to see a face not as God created it but as Picasso created it. He rearranged it so we would see what *he* had made. As he quipped about one of his Cubist portraits, "I had to make the nose crooked so they would see it was a nose."

By the late 1920s, as Cubism's influence filtered into the decorative arts, Braque produced some works that looked all the way back to Cézanne, such as *Still Life with Pears, Lemons and Almonds* from 1927.

Gibson
Les Paul
MODEL

By Bruce Watson

How to take on an ailing company—and make it hum

When three biz-school-trained entrepreneurs rescued Nashville's Gibson Guitar Corp., they created jobs—and saved a musical tradition

Gibson CEO Henry Juszkiewicz has revived the tradition of fine craftsmanship that shapes each guitar, including the classic Les Paul Standard (opposite).

In an industrial park just beyond earshot of Nashville's twang, a band tunes up each weekday morning. From all points around "Music City," guitarists, drummers and singers gather at a factory a few miles south of Opryland. As country music is piped above the scent of lacquer and sawdust, they share a little chin music, punch a clock and take last gulps of coffee. Then, as the day shift begins, they turn the factory floor into a stage.

Reaching into a rack of instruments, a ponytailed man in a T-shirt grabs a guitar. As if playing a scorching solo, he twirls it through the air before pressing its body against a buffing wheel. Across the factory, a graying man with a face chiseled in honky-tonks runs his fingers across frets, testing for the slightest buzz. At a workbench, a woman with the big hair of Nashville gently tweaks an electric guitar pickup. In any other factory, this might be mundane assembly work. But with business booming and musicians making guitars, each shift is another eight-hour gig for Gibson.

A decade ago, Gibson, one of America's long-playing instrument makers, was singing its swan song. Vintage Gibsons still sold for small fortunes, but the company whose strings had rung with country classics and rock hits was on the verge of bankruptcy. Then up stepped three thirtysomething entrepreneurs, rock'n'roll executives for the MTV era.

The partners who rescued Gibson love guitars. They also love rescuing failing companies, using the savvy they acquired at the Harvard Business School. With uncommon sense and high standards, they have upped Gibson's sales more than tenfold since 1986. Like the Gibson mural (p. 62) outside Nashville's Hard Rock Cafe, the Gibson name again stands tall in popular music. And in the factory, pride has returned to the product.

"More than half our employees are musicians, and in our final assembly, about 90 percent are," says Gibson CEO Henry Juszkiewicz, one of the three "boys from Harvard" who engineered Gibson's turnaround. "Musicians have to respect the instruments they're making. When we got here, the people who were making our instruments weren't buying them. By 1988, they were."

Before deciding to buy the company, Juszkiewicz and his partners visited the Nashville factory. There they saw a "very troubled plant," Juszkiewicz says. Morale was low, equipment was old. The factory was making just 75 guitars per day, and not a single one of Gibson's legendary banjos or mandolins. Among music industry experts, Gibson was regarded as history. But the guitar-totin' entrepreneurs asked musicians what they thought of Gibsons. "We found that young guitarists didn't know there was a problem," Juszkiewicz says. "They still thought Gibson was the best. The company was putting out some bad guitars, but the magic was still in the name. That's how we knew the company could be revived."

Photographs by Kim Steele

Gibson's Jim Hutchins (above) checks neck joining on reissue of 1952 model; replicas of classics, here awaiting completion (center), are very brisk sellers.

After seven months of negotiations, Juszkiewicz and his partners became the new owners of Gibson. Upon taking over, they began cutting costs. Schooled in the digital age, they replaced a $500,000 data-processing system with a $15,000 microcomputer. Streamlining from front office to factory floor, they lifted the company from its own sawdust. In ten years, Gibson has boosted its payroll from about 250 employees to nearly 1,000. And on Massman Drive, the "Nashville sound" recently involved not just guitars but the music of heavy equipment building huge additions to Gibson's factory.

Inside the factory, the Ghosts of Guitar Past are rising again. Above the hum of the factory floor, pale, unfinished guitars ascend a conveyor belt. These are the styles that made Gibson synonymous with strings—the Flying V played by Jimi Hendrix, archtop guitars played by early jazzmen, and stylish Les Paul models played by rock legends from Keith Richards to Paul McCartney.

The Gibson legend has its source further back in time, in founder Orville Gibson's 1890s. Gibson didn't know much about making money, but he had radical ideas about making mandolins—the folk fad instrument of the decade. On vaudeville stages, orchestras dressed in troubadour garb played Spanish fandangos, strumming gourd-like mandolins that looked like armadillos with strings. Other companies were churning out mandolins, but no one had ever seen, or heard, anything like Gibson's model. Not bowl-backed like the others, his mandolin, patented in 1898, was flat and pear-shaped, with a carved top like a violin's.

In his shop on Main Street in Kalamazoo, Michigan, Gibson handcrafted his louder, deeper-toned mandolins, mandolas and mando-cellos. Demand for "The Gibson" soon outpaced supply. To expand production, the Gibson Mandolin-Guitar Mfg. Corp., Ltd., was formed in 1902. The first stockholders included three lawyers, a music teacher, a salesman and Orville Gibson.

Sales skyrocketed; Gibsons were soon played by entire mandolin orchestras. Gibson himself, though, was a luthier, not a businessman. Although his glaring face was on the label affixed to every instrument, Gibson soon quarreled with his partners and sold his stock. After his royalty agreement ran out in 1908, he was granted a modest $500 a year, paid in monthly installments until his death in 1918, at the age of 62.

Today, Gibsons are sold in 50 countries. The original company headquarters and factory in Kalamazoo closed down in 1984. The Gibson empire now consists of two

Author Bruce Watson, who plays acoustic guitar and banjo, has also written for SMITHSONIAN *on the enduring, international appeal of bluegrass music.*

Meticulous handwork goes into each reissue: the rim is prepared on a '34 Super 400 clone (above); a border on a replica '55 ES-5 Switchmaster (below) is finished.

huge factories—the one in Nashville and another installation in Bozeman, Montana—where instruments are rough-carved by computerized routers and blueprints are digitized on software. Yet Gibson has maintained its founder's sense of craftsmanship.

Broken down to its component parts, a guitar amounts to various hunks of wood, some metal and a little plastic. But, as any musician will tell you, a guitar is more than the sum of its parts. Even guitarists who own several models usually have one special guitar, their "baby," "box" or "axe," with the perfect look, feel and sound. The difference between perfection and mere playability is as slim as a guitar string—about one-hundredth of an inch—and the making of guitars is precise work. Wood provides the resonance: Gibson employs brokers scouting wood from Maine to Cameroon.

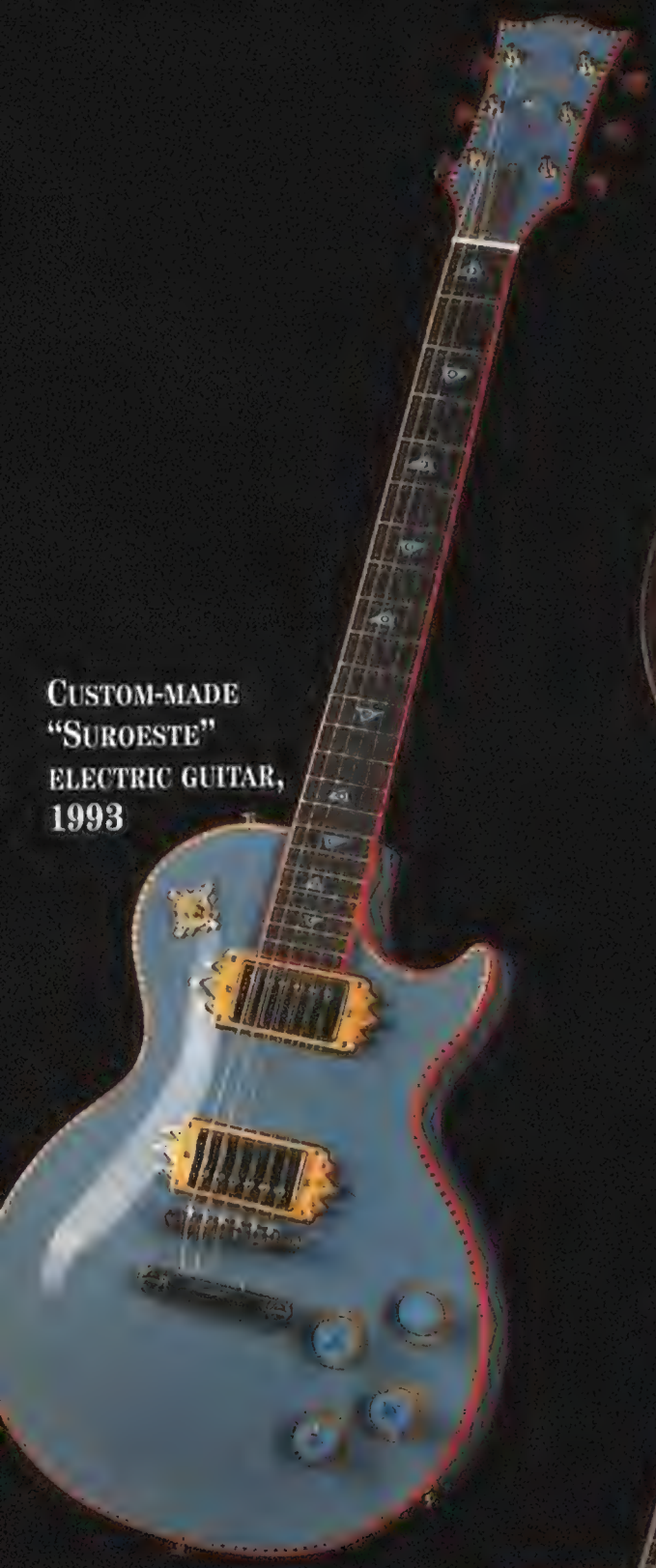
But a fine guitar depends on finely tuned construction. Acoustic guitars include delicate braces inside, shaved to exacting shapes to produce precise tones. A guitar neck must be attached to the body at the proper angle. Too high and the guitar will torture the fingers; too low and the strings will buzz against upper frets.

Having seen individual luthiers at work, I went to Nashville to see how Gibson has turned the art into a science. My guide, a walking catalog of know-how, is known to everyone on the shop floor as "Hutch." Trained as a tool-and-die maker, Jim Hutchins is a manager in Gibson's Custom and Art Division, where they create clones of Gibson classics, known as reissues. (Here they also take special orders for custom electric and acoustic guitars costing as much as $18,000 apiece.)

At the moment, though, Hutchins is showing me around the mass production departments where more than 80,000 electric guitars are made each year. Producing craftsmanship on the large scale is simple, Hutchins tells me. You just figure out what tasks machines can do as well as hands, and what demands a human touch. From fiery kilns for drying raw wood to rooms where guitars are sprayed with lacquer, Gibson blends the craftsmanship of the 1890s with the technology of the 1990s. "We never do anything the easy way," Hutchins says. "Some things machines just can't do right."

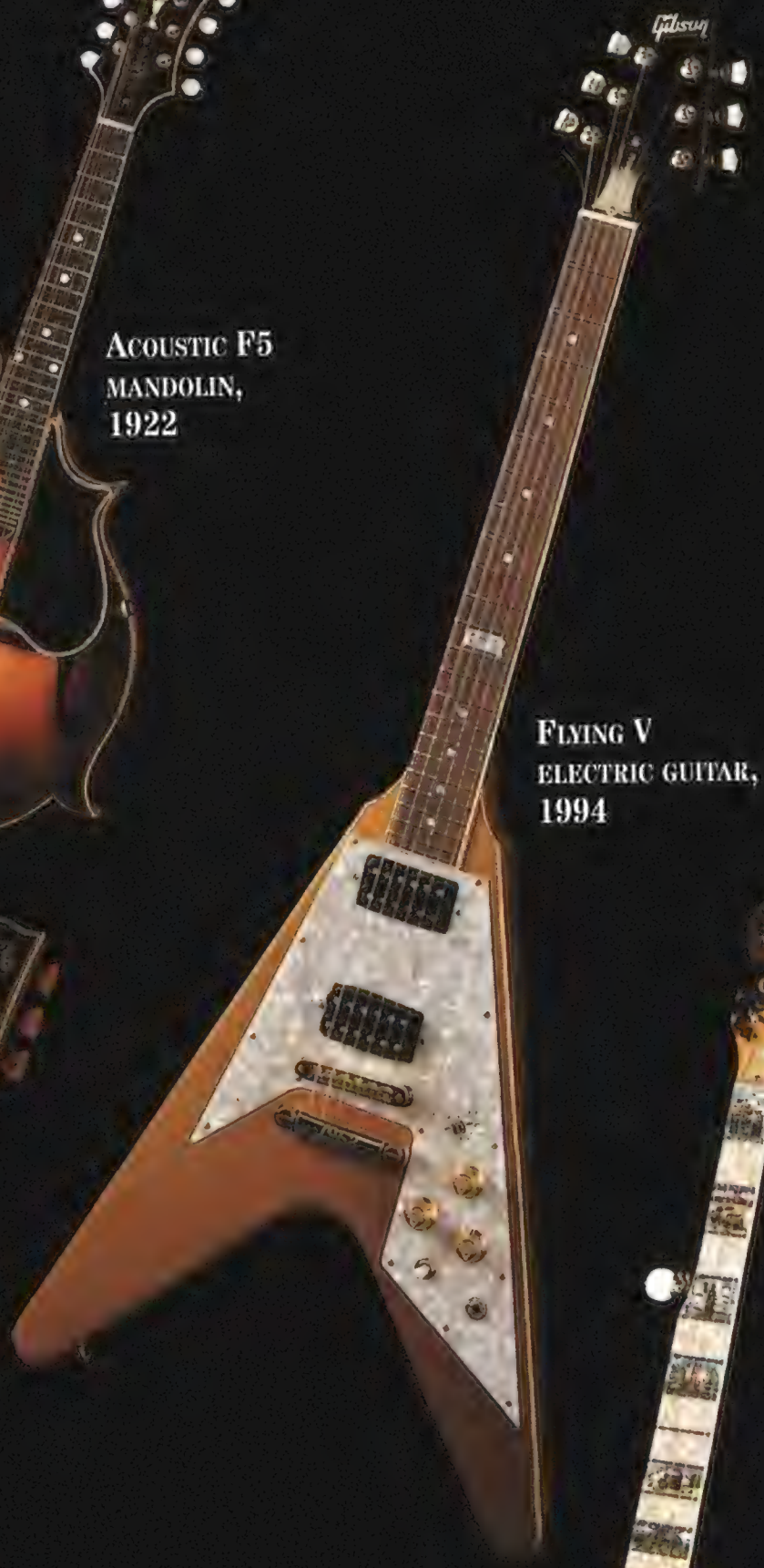
A century after Orville opened his shop, a Gibson is made by many hands. In its early stages, the process looks like carpentry. Lumber is cut by band saws. Rough guitar necks are stacked like fence posts; future fingerboards are just slabs of ebony cut to size. But as Hutchins moves me through the factory, stopping to talk shop with other workers, the production process becomes more refined. Calipers measure the thickness of veneer. Frets are sawed by machine, for accuracy; a fret even slightly out of line will render a guitar perpetu-

A Gallery of Gibsons

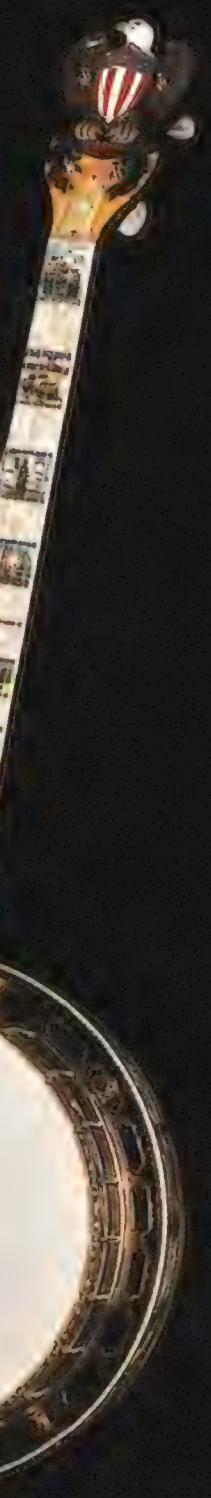


Custom-made
"Suroeste"
electric guitar,
1993

Acoustic F5
mandolin,
1922



Flying V
electric guitar,
1994



Acoustic L5
jazz guitar,
1941

All
American
banjo,
1994

ally out of tune. Necks are fitted one by one. Pickups are inserted and tested. The final product is played and sent to shipping or sent back for more work. By the time a guitar is sent out, it has passed through the hands of at least 30 craftsmen and spent four to six weeks on the shop floor.

Despite such precision in production, Gibson is turning out more than 300 guitars per day now. And industry experts say the quality of all Gibson guitars is as good as ever. "Gibson's electric reissues are remarkably good," says guitar guru George Gruhn, author of several books on American guitars. "Although I still prefer the sound of vintage guitars, it takes a fair degree of sophistication to tell the difference." Further testimony comes from the handwriting on the wall, the wall of the custom shop, that is. There, Fifties rocker Duane Eddy, the Jefferson Starship's Jorma Kaukonen and dozens of other stars—from jazz guitarist Lee Ritenour to country singer Reba McEntire—have signed their praises and hung their platinum records.

In addition to craftsmanship, Gibson has valued innovation. Two musician-inventors were crucial to the company's evolution. Lloyd Loar's mandolins cost a chunk of change for their day. During the 1920s, $250 could buy five ordinary mandolins. But Loar fine-tuned his instruments with a longer neck, graduated sound boards, and tone bars. His guitars backed the country songs of the Carter Family; his mandolins made Bill Monroe's bluegrass high and lonesome. Loar's designs are still used in Gibson's Bozeman, Montana, factory. But maybe you'd rather have an original: these days, a 1923 Loar mandolin costs about $40,000.

To the fore: full-sized electrics

If Loar was Gibson's Stradivarius, then Les Paul is its Edison. Paul did not invent the electric guitar. No single inventor did. The first electrics, made in the late 1920s, were frying pan-shaped instruments playing ersatz Hawaiian hits. By the 1940s, Paul, Leo Fender and country picker Merle Travis had all begun tinkering with full-sized electrics fashioned from solid hunks of wood.

The solid-body electric guitar is a quantum leap, forward or backward depending on your taste, from the simple wooden six-string acoustic. An acoustic guitar holds a note only as long as a string vibrates, and its hollow body—necessary as a sound chamber—absorbs some of the force of the string's vibration. An electric solid body is designed to eliminate that dampening effect.

An electric also pumps up the volume with pickups, coil-wound magnets that turn the vibrations of metal strings into electronic pulses. The pulses are fed into an amplifier where the sound can be distorted, sustained longer or just blasted until parents scream for mercy. But in pioneering the electric guitar, Paul wasn't looking only for a louder instrument. Well on his way to becoming an accomplished jazz guitarist, he wanted a guitar that could hold a single note up to 20 seconds. With such an axe, he could play elaborate solos, soaring with the sax and bottoming out with the bass.

Country legend Chet Atkins, musician and guitar designer, strums an instrument he created for Gibson.

Paul made his first solid-body guitar out of a piece of railroad track. Another time he sawed a hollow-body acoustic in pieces and attached its curved sides to a 4-by-4-inch pine log. Adding pickups he rewired from an electric clock, Paul created the "Log." One of the earliest solid-body guitars, it is now enshrined in Nashville's Country Music Hall of Fame and Museum. When Paul approached Gibson with his creation, the company turned him away. "We didn't think it took a lot of skill to build a plank of wood that made a shrill sound," said Ted McCarty, Gibson's president at the time. But by 1950, Gibson was in need of shock treatment. The Depression had forced the company to make wooden toys—boats, ducks and rabbits. During World War II, when Big Bands were the rage, Gibson made more radar assemblies than guitars. So when postwar pickers began buying electric guitars made by Leo Fender's company, Gibson got in step with the loud music.

As with most creation stories, various myths surround the genesis of Gibson's Les Paul guitars. The stories harken back to the year 4 B.C.B. (Before Chuck Berry), when the hit parade was dominated by soft crooners like Perry Como and Patti Page. According to one legend, in 1951 Gibson's president took the company's first solid-body electric guitar to the mountaintop—Paul's studio atop the Delaware Water Gap. Paul played the model in an all-night talk session, then lent his name and expertise to Gibson. But another story says Paul came down from the mountain bearing his Log and a Fender, bound for another try at Gibson. He convinced Gibson to let him design his own prototype which, with a few changes, begat the famous Les Paul guitars. Which story

Many employees who craft Gibsons by day also play them by night. A typical weekend at Shooters, a local bar, features guitarists Terry Ryan (left), of the Custom and Art Division, and his coworker Scott Harrison.

one believes depends on one's faith in individual genius or corporate savvy. But regardless of who actually designed the first Les Paul, guitarists around the world heard it and said it was good.

By the mid-1950s, electric guitars were as ubiquitous as tail fins and T-birds. Sleek and slightly sexy, they were perfect for a plastic age. Each was laden with electronic gewgaws. They were fun to twirl onstage like a dance partner. And they were available not just in wood hues but in a rainbow of colors. Gibsons played Bill Haley's "Rock Around the Clock," tunes by Buddy Holly and the Everly Brothers, and the rockabilly licks that backed Elvis.

With the rock revolution in full swing, boys (yes, mostly boys) began pestering parents to buy them electric guitars. One such boy was Gibson's future CEO. Henry Juszkiewicz got his first guitar at age 10, in 1963. It was not a Gibson, he confessed. "Parents didn't buy Gibsons as first guitars back then." But by high school, playing "Twist and Shout" in garage bands in Rochester, New York, Juszkiewicz had his eyes on the company's prize. "Everyone knew Gibson was the primo guitar," recalls Juszkiewicz, perhaps America's only CEO whose vocabulary blends the lingo of *Fortune* and *Rolling Stone*. "I remember one day some guy brought over a Les Paul. You couldn't pry it out of my hands. It was a stellar instrument."

Like millions of others, Juszkiewicz strummed through the 1960s and '70s, straddling his vocation and avocation. He loved the guitar and played whenever he could, but his calling was engineering. While attending the General Motors Institute in Flint, Michigan, he played in bands for weddings and parties.

Juszkiewicz worked for GM after graduating, then in 1977 he enrolled at the Harvard Business School. There, while playing lead guitar for Tony and the Tycoons, he met David Berryman and Gary Zebrowski. Sharing a dream of entrepreneurship, they became close friends. Upon graduating, they went separate ways—Juszkiewicz headed for Wall Street—but kept in touch. In 1982 they pooled their resources, bought a struggling data tape company in Oklahoma and quickly turned a profit. Then in 1985, Juszkiewicz got a tip on another failing company ripe for acquisition. "Gibson?" Juszkiewicz replied. "No, Gibson's a huge company. We're not in a position to take over Gibson."

But the company was nearly insolvent. The fall had been steep and steady. Gibson had enjoyed its finest years in the 1960s. First the folk boom, then the British invasion led by the Beatles, had made guitars the sine qua non of style. In 1965 Gibson sold 100,000 guitars. It seemed the good times would never end. But four years later, the company was bought by Ecuadorian Company, Ltd., a conglomerate whose experience in music amounted to making the beer that audiences drank.

These dark days are recalled with horror stories. Gibson historian Walter Carter speaks of "uninformed decision making" by managers who knew little about guitars and whole bins of shoddy Gibsons returned to the factory. The new owners opened the Nashville plant in 1975,

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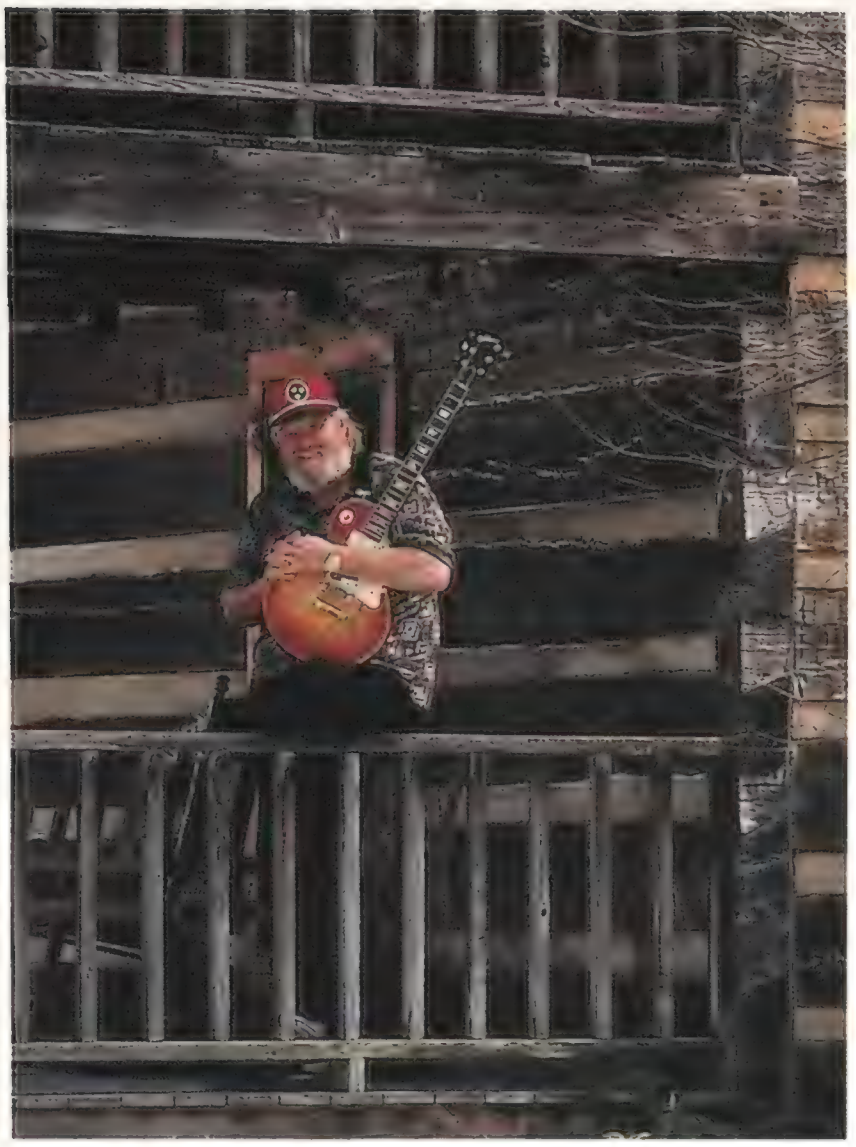

At home in Mount Juliet, Tennessee, country star Charlie Daniels holds his prized Gibson, a Les Paul.

but they also severed ties to Kalamazoo, shutting the Michigan factory in 1984. Juszkiewicz speaks tactfully of his predecessors: "The company had a lot of poor product." But Jim Hutchins, who saw whole families laid off and some 400 people lose their jobs, is more blunt. "A bunch of guys up in New York were making decisions and didn't know what they were doing. It took them only ten years to bury the company, and I mean *bury* it."

Gibson's decline was not solely due to management. By the late 1970s, riding a weak dollar, Japanese imports like Yamaha and Ibanez claimed half the six-string market. By the time Juszkiewicz got the word on Gibson, the company was for sale at $15 million, and there were no takers. The "boys from Harvard" acquired factory, frets, debts and the Gibson name for $5 million.

"Industry wisdom was that we'd be gone in 18 months," says Juszkiewicz, just 32 when he became CEO. Undaunted by rumors, the new owners went right to work. First they pruned—laying off 30 employees, including all top managers. Then they tuned. Quashing rumors that they were Japanese-owned, they changed the company logo to "Gibson USA." Under new management and a new label, the team turned to the factory floor. There they began steadfastly sawing guitars in half.

During the company's decline, factory "seconds" were sold at a discount. Juszkiewicz quickly put a stop to the practice. "I didn't feel," he says, "that anything with the Gibson name should be a second." The company cut up whole bins of bad guitars and still destroys at least 100 seconds per week. Gibson then began studying its original success. Craftsmen took apart old pickups to learn forgotten secrets. They dug out dies from classic guitars and put them back into production. Then they retooled the factory from the saws that cut Sitka spruce to the routers that shape curly maple.

"Henry's not like a lot of CEOs," Hutchins says. "You can talk to him about engineering or about guitars. He knows that the neck's gotta be just right or it's going to buzz. And he gave us the money and machinery to get this plant back to where it ought to be."

But as Orville Gibson knew, no matter how fine a luthier's tools, an instrument is only as good as the hands that make it. So Gibson began hiring hands that played guitars, hands like David Lindsey's. Like so many other musicians, Lindsey, a native Oklahoman and guitarist, moved to Nashville to play in a band. By night, he plays any one of his seven Gibsons on local stages. By day, he fine-tunes fret boards. "Playing guitar helps me do this work because it gives me a standard to live up to," Lindsey says as he taps a stubborn fret. "This is also a more stable job than playing music for a living." One former factory hand, country star Joe Diffie, was working in Gibson's final assembly line when he got his first record contract. But most Gibson employees play for sheer love of the guitar. And every other month, they play overtime.

It's a Friday night, hours after the day shift has punched out. For most factory workers, it's time to put the company out of sight and mind. But a ragtag bunch of musicians has taken over the stage at Shooters, a sports bar a few miles from the Gibson plant. Like the mandolin orchestras of Orville's time, at this "Gibson Jam" every one is a "Gibsonite." Onstage, Randy Russell, a final inspector by day, plays lead guitar. Troy Jones, who works on guitar necks in the custom shop, plays drums. Inspection-line repairman David Simms is on bass. Dot Smith, who solders electronic assemblies, is at the microphone. And when he's not traveling, backing the band on guitar is Henry Juszkiewicz, CEO.

Whether jamming or meeting a production quota, Gibson's band is doing the company name proud. But like all music, the company's success also depends on timing. Baby Boomers who once traded their guitars for hard-driving careers have again found time to play. Many are in the market for six-stringed nostalgia.

Walt McKee never cut a record. His name is not included among the stars who played Gibsons. But strolling through the Gibson display in Nashville's Country and Western Hall of Fame and Museum last summer,

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McKee, a native of the Philadelphia suburbs, couldn't help but reminisce. "First guitar I ever had was a Gibson," McKee says, recalling garage bands that aped the Animals and the Monkees. "It was an old hollow-body. I've long since given it away. I always missed the sound of that guitar. They don't make 'em like they used to."

Yes, they do. They make 'em *exactly* like they used to. In 1991 Gibson inaugurated its Historic Collection, now part of the Custom and Art Division, to make copies of its old models. Can't cough up the price of a new car for an original 1960 Les Paul Standard? Don't fret. You can pay just $6,699 for a reissue, from tailpiece to tuners an exact replica. (Or you can go for the more economical version, a new Les Paul Classic, modeled on the 1960 original but not a clone, for $2,050.) Gibson offers almost 20 blasts from the company's past. Demand has each guitar back-ordered for months.

Having restored Gibson's pride and past, Juszkiewicz is following Gibson's tradition of thinking big. "Our goal is to be the largest musical instrument company in the world," he flatly declares. If the goal sounds stratospheric, consider that Gibson has already reached beyond the Solar System. The lightning riffs of Chuck Berry's "Johnny B. Goode" are even now soaring through space on a copper record inside the spaceship *Voyager*. Back on Earth, Gibson is branching out. Since 1986 the company has acquired firms making mandolins, keyboards, Dobro resonator guitars, drums, bass guitars and amplifiers to bring it all back home. Most importantly, its CEO says, Gibson again rings with the enthusiasm of its namesake, albeit with a different vocabulary. "With the old guitars, quality depended a lot on the year it was made," Juszkiewicz says. "Production was inconsistent, woods varied. We've improved our equipment and specifications almost to the point of lunacy. Today I'll guarantee every one of our guitars 'cherry.'"

From one-man beginnings to top-quality guarantees, Gibson keeps on pickin'. In 1994, when the company unveiled its Centennial guitar, a Les Paul Custom with solid-gold hardware, there on the peg head was a stern, mustachioed face. Orville Gibson seemed to be reminding his successors to make music worthy of his name.

The Hard Rock Cafe's 40-by-260-foot mural of a Les Paul guitar, by British artist Milree Hughes, has become a familiar landmark in downtown Nashville—and a testament to Gibson's remarkable resurgence.

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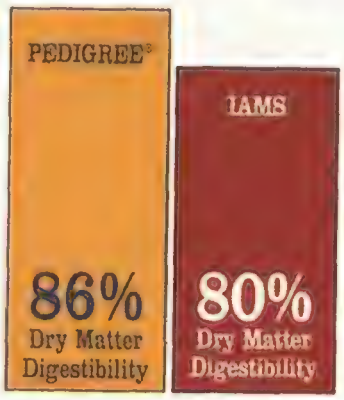

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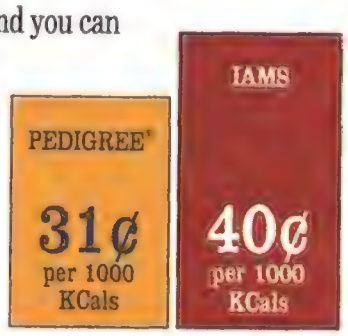

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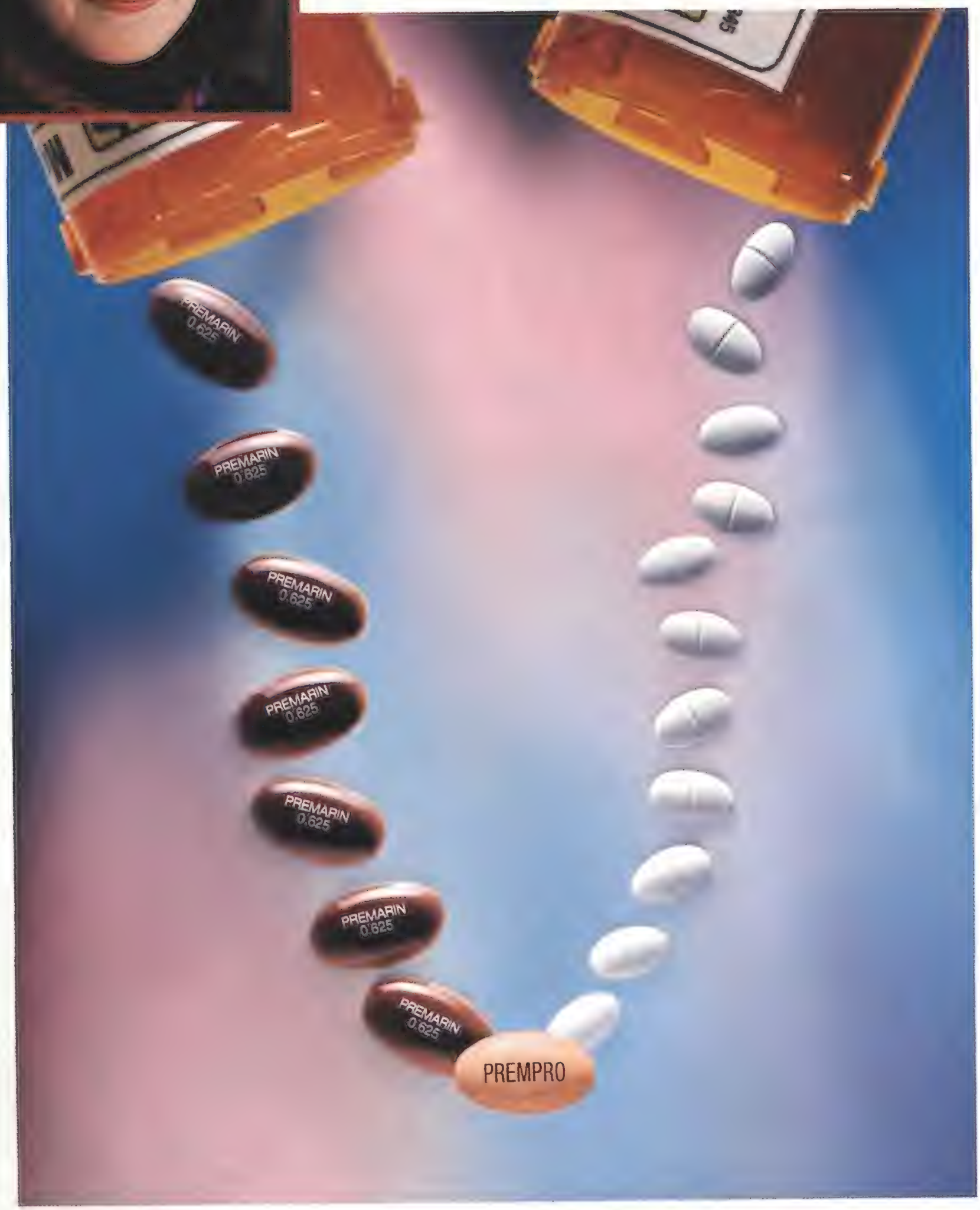

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When you speak to your doctor or health care provider about hormone replacement therapy, be sure to discuss your personal and family history of breast cancer, breast lumps, abnormal vaginal bleeding, abnormal blood clotting, severe headache, dizziness, or liver disease. Women who are pregnant should not take hormone replacement therapy because of possible risk to the fetus.

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ONE-TABLET PREMPRO™

PREMPRO™

(conjugated estrogens/medroxyprogesterone acetate tablets)

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Please be sure to read the important information on the following page.

BRIEF SUMMARY OF PRESCRIBING INFORMATION FOR THE PATIENT

PREMPRO™ Brand of conjugated estrogens/medroxyprogesterone acetate tablets.
This summary describes when and how to use estrogen/progestin drugs and the benefits and risks of treatment.

ESTROGENS INCREASE THE RISK OF CANCER OF THE UTERUS IN WOMEN WHO HAVE HAD THEIR MENOPAUSE ("CHANGE OF LIFE"). *THIS FINDING REFERS TO ESTROGENS GIVEN WITHOUT PROGESTIN.*
Progestin drugs taken with estrogen-containing drugs significantly reduce but do not eliminate this risk. If you use any estrogen-containing drug, it is important to visit your doctor regularly and report any unusual vaginal bleeding right away. Vaginal bleeding after menopause may be a warning sign of uterine cancer. Your doctor should evaluate any unusual vaginal bleeding to find out the cause.

ESTROGENS/PROGESTINS SHOULD NOT BE USED DURING PREGNANCY.
Estrogens do not prevent miscarriage (spontaneous abortion) and are not needed in the days following childbirth. If you take estrogens during pregnancy your unborn child has a greater than usual chance of having birth defects. These birth defects may affect the baby's urinary system and sex organs.

ESTROGEN/PROGESTIN DRUGS

PREMPRO is a combination of two hormones, an estrogen and a progestin. This hormone combination has been shown to provide the benefits of estrogen replacement therapy while lowering the frequency of a possible precancerous condition of the uterine lining. This therapy is not intended for women who have had a hysterectomy (surgical removal of the uterus).

Estrogens have several important uses but also some risks. You must decide, with your doctor, whether the risks of estrogens are acceptable when weighed against their benefits. Check with your doctor to make sure you are using the lowest possible effective dose.

With PREMPRO therapy several menstrual-like bleeding patterns may occur. These may range from absence of bleeding to irregular bleeding. If bleeding occurs, it is frequently light spotting or moderate menstrual-like bleeding, but it may be heavy. Please discuss your bleeding pattern and set up an appropriate schedule for follow-up care with your physician.

USES OF ESTROGEN

To reduce menopausal symptoms. Estrogens are hormones produced by the ovaries of normal women. The decrease in the amount of estrogen that occurs in all women, usually between the ages of 45 and 55, causes menopause. Sometimes the ovaries are removed during an operation causing "surgical menopause." When the amount of estrogen begins to decrease, some women develop very uncomfortable symptoms, such as feelings of warmth in the face, neck, and chest, or sudden intense episodes of heat and sweating ("hot flashes" or "hot flushes"). Using estrogen drugs can help the body adjust to lower estrogen levels and reduce these symptoms. Some women have none or only mild menopausal symptoms; in others, symptoms can be severe. These symptoms may last only a few months or longer. Taking PREMPRO can alleviate these symptoms. If you are not taking hormones for other reasons, such as the prevention of *osteoporosis, you should take PREMPRO only as long as you need it for relief from your menopausal symptoms.*

To prevent brittle bones. After age 40, and especially after menopause, some women develop osteoporosis. This is a thinning of the bones that makes them weaker and more likely to break, often leading to fractures of spine, hip, and wrist bones. Taking estrogens after the menopause slows down bone loss and may prevent bones from breaking. Eating foods that are high in calcium (such as dairy products) or taking calcium supplements (1000 to 1500 milligrams per day) and certain types of exercise may also help prevent osteoporosis. Since estrogen use is associated with some risks, its use in the prevention of osteoporosis should be limited to women who appear susceptible to this condition. The following characteristics are often present in women who are likely to develop osteoporosis: white or Asian race, thinness, cigarette smoking, family history, and early or surgical menopause.

To treat vulvar and vaginal atrophy (itching, burning, dryness in or around the vagina, difficulty or burning on urination) associated with menopause

WHEN ESTROGENS SHOULD NOT BE USED

During pregnancy (see Boxed Warning). If you think you may be pregnant, do not use any form of estrogen-containing drug. Using estrogens while you are pregnant may cause your unborn child to have birth defects. Estrogens do not prevent miscarriage.

If you have unusual vaginal bleeding which has not been evaluated by your doctor (see Boxed Warning). Unusual vaginal bleeding can be a warning sign of cancer of the uterus, especially if it happens after menopause. Your doctor must find out the cause of the bleeding so that he or she can recommend the proper treatment. Taking estrogens without visiting your doctor can cause you serious harm if your vaginal bleeding is caused by cancer of the uterus

If you have had cancer. Since estrogens increase the risk of certain types of cancer, you should not use estrogens if you have ever had cancer of the breast or uterus

If you have any circulation problems. Estrogen drugs should not be used except in unusually special situations in which your doctor decides that you need estrogen therapy so much that the risks are acceptable. Women with abnormal blood clotting conditions should avoid estrogen use (see **RISKS OF ESTROGENS AND/OR PROGESTINS**).

When they do not work. During menopause, some women develop nervous symptoms or depression. Estrogens do not relieve these symptoms. You may have heard that taking estrogens for years after menopause will keep your skin soft and supple and keep you feeling young. There is no evidence for these claims and such long-term estrogen use may have serious risks.

After childbirth or when breast-feeding a baby. Estrogen should not be used to try to stop the breast from filling with milk after a baby is born. Such treatment may increase the risk of developing blood clots (see **RISKS OF ESTROGENS AND/OR PROGESTINS**)

If you are breast-feeding, you should avoid using any drugs because many drugs pass through to the baby in the milk. While nursing a baby, you should take drugs only on the advice of your health care provider.

RISKS OF ESTROGENS AND/OR PROGESTINS

Cancer of the uterus. The risk of cancer of the uterus increases when estrogens are used alone, the longer they are used, and when larger doses are taken. There is a higher risk of cancer of the uterus if you are overweight, diabetic, or have high blood pressure.

The hormone combination you will be taking contains estrogen and progestin. This combination has been shown to provide the benefits of estrogen replacement therapy while reducing the risk of a precancerous condition of the uterine lining.

Additional risks may be associated with the inclusion of a progestin in estrogen treatment. The possible risks include unfavorable effects on blood fats and sugars. Usually, the smaller the dose and the shorter the duration of treatment, the more these effects are minimized. Check with your doctor to make sure you are using the lowest effective dose and only for as long as you need it.

Cancer of the breast. Most studies have not shown a higher risk of breast cancer in women who have ever used estrogens. However, some studies have reported that breast cancer developed more often (up to twice the usual rate) in women who used estrogens for long periods of time (especially more than 10 years), or who used high doses for shorter time periods. The effects of added progestin on the risk of breast cancer are unknown. Some studies have reported a somewhat increased risk, even higher than the possible risk associated with estrogens alone. Others have not. Regular breast examinations by a health professional and monthly self-examination are recommended for all women.

Gallbladder disease. Women who use estrogens after menopause are more likely to develop gallbladder disease needing surgery than women who do not use estrogens.

Inflammation of the Pancreas. Women with high triglyceride levels may have an increased risk of developing inflammation of the pancreas.

Abnormal blood clotting. Taking estrogens may increase the risk of blood clots. These clots can cause a stroke, a heart attack, or a pulmonary embolus, any of which may cause death or serious long-term disability.

Excess calcium in the blood. Taking estrogens may lead to severe hypercalcemia in women with breast and/or bone cancer.

During pregnancy. There is an increased risk of birth defects in children whose mothers take this drug during the first four months of pregnancy. Several reports suggest an association between mothers who take these drugs in the first trimester of pregnancy and genital abnormalities in male and female babies. The risk to the male baby is the possibility of being born with a condition in which the opening of the penis is on the underside rather than the tip of the penis (hypospadias). Hypospadias occurs in about 5 to 8 per 1,000 male births and is about doubled with exposure to these drugs. There is not enough information to quantify the risk to exposed female fetuses. However, enlargement of the clitoris and fusion of the labia may occur, although rarely.

Therefore, since drugs of this type may induce mild masculinization of the external genitalia of the female fetus, as well as hypospadias in the male fetus, it is wise to avoid using the drug during the first trimester of pregnancy. These drugs have been used as a test for pregnancy, but such use is no longer considered safe because of possible damage to a developing baby. Also, more rapid methods for *testing for pregnancy are now available. If you take PREMPRO and later find you were pregnant when you took it, be sure to discuss this* with your doctor as soon as possible.

SIDE EFFECTS WITH ESTROGENS AND/OR PROGESTINS

In addition to the risks listed above, the following side effects have been reported with estrogen and/or progestin use:

- Nausea, vomiting; pain, cramps, swelling, or tenderness in the abdomen.
- Yellowing of the skin and/or whites of the eyes.
- Breast tenderness or enlargement.
- Enlargement of benign tumors of the uterus.
- Irregular bleeding or spotting.
- Change in amount of cervical secretion.
- Vaginal yeast infections.
- Retention of excess fluid. This may make some conditions worsen, such as asthma, epilepsy, migraine, heart disease, or kidney disease.
- A spotty darkening of the skin, particularly on the face; reddening of the skin; skin rashes.
- Worsening of porphyria.
- Headache, migraines, dizziness, faintness, or changes in vision (including intolerance to contact lenses).
- Mental depression.
- Involuntary muscle spasms.
- Hair loss or abnormal hairiness.
- Increase or decrease in weight.
- Changes in sex drive.
- Possible changes in blood sugar.

REDUCING THE RISKS OF ESTROGEN/PROGESTIN USE

If you decide to take an estrogen/progestin combination, you can reduce your risks by carefully monitoring your treatment.

See your doctor regularly. While you are taking PREMPRO, it is important to visit your doctor at least once a year for a checkup. If you develop vaginal bleeding while taking estrogens, you may need further evaluation. If members of your family have had breast cancer or if you have ever had breast lumps or an abnormal mammogram (breast X ray), you may need to have more frequent breast examinations.

Reassess your need for treatment. You and your doctor should reevaluate your need for estrogens at least every six months.

Be alert for signs of trouble. Report these or any other unusual symptoms to your doctor immediately:

- Abnormal bleeding from the vagina.
- Pains in the calves or chest, a sudden shortness of breath, or coughing blood.
- Severe headache or vomiting, dizziness, faintness, or changes in vision or speech, weakness or numbness of arm or leg.
- Breast lumps.
- Yellowing of the skin and/or whites of the eyes.
- Pain, swelling, or tenderness in the abdomen.

OTHER INFORMATION

Estrogens increase the risk of developing a condition (endometrial hyperplasia) that may lead to cancer of the lining of the uterus. Taking progestins, another hormonal drug, with estrogens lowers the risk of developing this condition.

You should know, however, that taking estrogens *with* progestins may have unhealthy effects on blood sugar, which might make a diabetic condition worse.

Some research has shown that estrogens taken *without* progestins may protect women against developing heart disease. However, this is not certain. The protection shown may have been caused by the characteristics of the estrogen-treated women and not by the estrogen treatment itself. In general, treated women were slimmer, more physically active, and were less likely to have diabetes than the untreated women. These characteristics are known to protect against heart disease.

It is important to discuss, in detail, with your doctor or health care provider all the possible risks and benefits of long-term estrogen and progestin treatment as they affect you personally.

This Summary provides the most important information about PREMPRO. If you want to read more, ask your doctor or pharmacist to let you read the professional labeling.

This Brief Summary for Direct-to-Consumer Advertising is based on the current PREMPRO Tablets insert (PI 4665-1) issued November 15, 1995 with the incorporation, in lay language, of pertinent text from the Physician Insert, (CI 4664-1) issued November 17, 1995.

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A SAMPLING OF LEARNING ADVENTURES FOR SMITHSONIAN ASSOCIATES

"Please, I'll never ask for anything again, let me make it to the top of this hill."
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By Richard Conniff

'Dragonflies are an odd combination of beautiful things'

Don't be misled by their dainty appearance: these ornaments of summer are aggressive predators, amazing fliers and bizarre suitors

Dew-covered skimmer called *Ladona* rests on a wood lily. Skimmers are commonly found around quiet water.

A hot summer morning at the Slaughter Ranch in southeastern Arizona, everything lazy and slow. The pond by the house is stippled with small green knobs that look like water lily buds but turn out, on closer examination, to be the golden eyes of a hundred hungry bullfrogs. The surface is clotted in places with mats of yellow algae. There is no wind to stir the willows. Only the dragonflies are moving. "There's *onusta* coming around that tree," a dragonfly enthusiast calls out in a nasal voice. Then he corrects himself. "No, that's *saturata*, with *multicolor* just out ahead."

"You sound like you're calling a horse race," another collector says.

"And it's *saturata* by a head!"

"By a frons!"

It occurs to me that a racetrack isn't quite the right metaphor. Too many other things are happening here. Territories are being gained and lost, rivals run off, mates wooed. I watch a member of the species *Anax junius*, built like a 747, patrol overhead, then hesitate in midair to seize a fly and gnash it. The racetrack announcer coils and swings, his net whistling through the air. He extricates his catch, its huge wings held together between thumb and forefinger, and presents it to the youngest member of the Dragonfly Society of the Americas, an 8-year-old in a web vest and round, wire-rimmed glasses named Ben Lane.

It's a brilliant blue-and-green creature, the length and breadth of the boy's hand. Its eyes are opalescent pools. The racetrack announcer explains that *Anax junius* means "lord and master of June" and the hunting behavior is called "hawking."

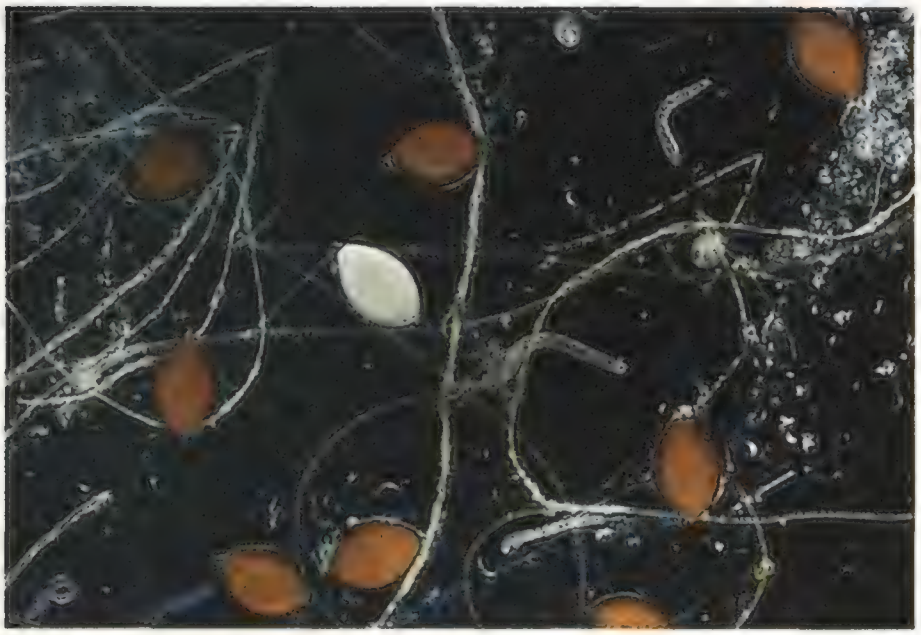
It becomes clear, the longer Ben holds the dragonfly without being eaten alive or lifted into the treetops, that the most dangerous thing about dragonflies is the danger of mixed metaphors. Dragons, horse races and hawks are the least of it.

Southern folklore holds that dragonflies are servants of snakes and revive them, Lazarus-like, from the dead.

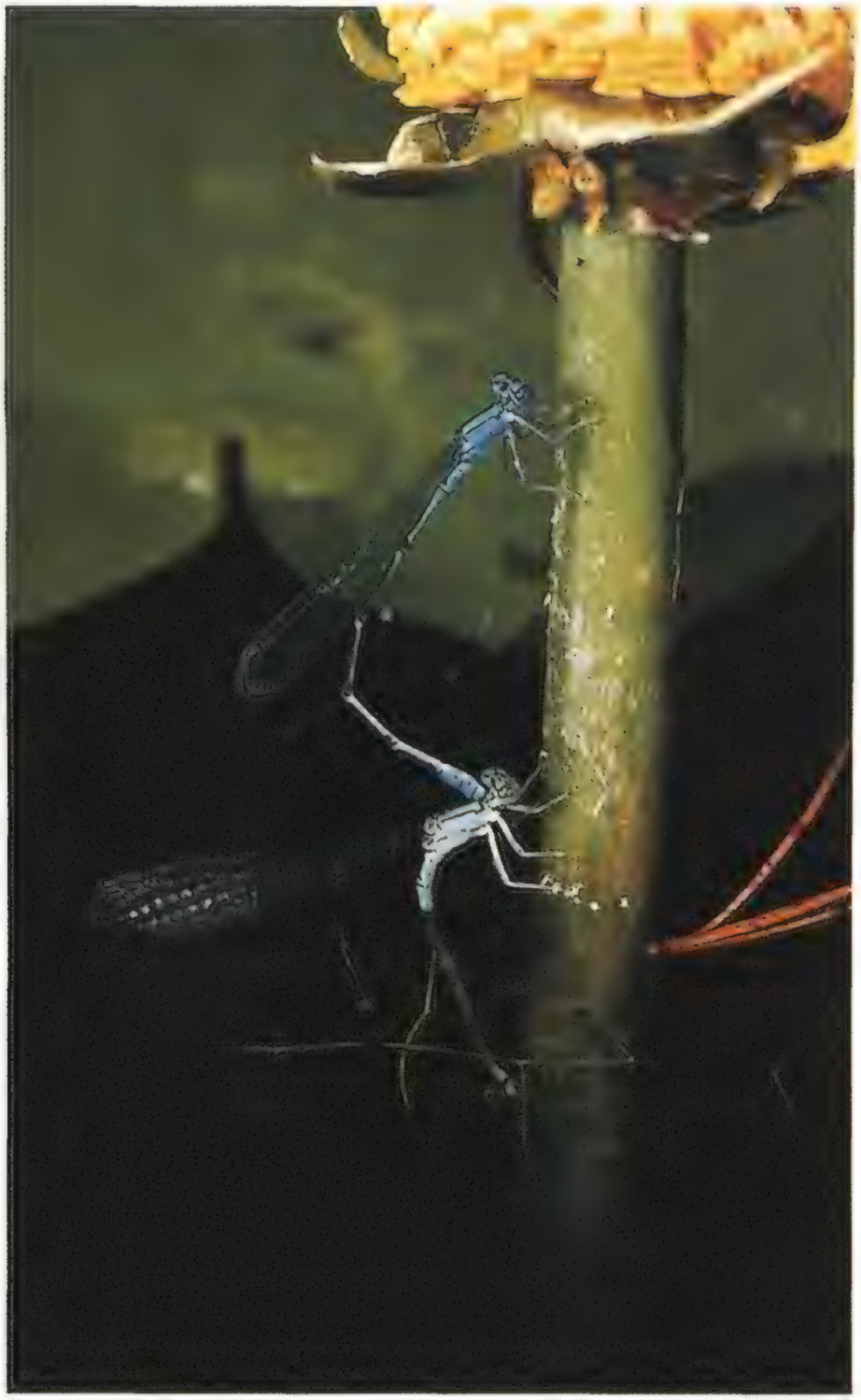
The showy dragonflies are named for the way they skim along the surface of a pond or just above the shore. There are 96 skimmer species in North America. Many are capable of great maneuverability and speed.

Hence the name "snake doctor." Dragonflies are also called "devil's darning needles" because they supposedly are capable of stitching together the lips of wicked children in their sleep. Other nicknames include "eye stickers" and "mule killers."

It probably figures that a syringe-shaped insect with a five-inch wingspan and eyes lit up like Christmas ornaments might seem vaguely menacing. But we know better now. The deadly-looking hind end is not a stinger. It's a kind of tow-truck grappling hook in the male, and in the female, an ovipositor, or egg-laying device. Although dragonflies (a term that commonly includes their close kin the damselflies) are members of the order Odonata, meaning "toothed ones," their teeth can deliver nothing worse to humans than a good pinch. The dragonfly's bomb-bay mouth is built for catching and grinding up stuff like mosquitoes at a rate of about 300 a day.



Fertile dragonfly eggs turn brown after they are laid. The cream-colored egg floating on the surface is sterile.



Female damselfly (bottom) deposits fertilized eggs in plant tissue while still-attached male stands guard.

This may be one reason the dragonfly is currently enjoying something like a social rehabilitation in this country. Several years ago, some of its admirers formed the Dragonfly Society of the Americas. The most devoted members dig ponds or plant old bathtubs as dragonfly breeding sites, and New York City's Central Park even has a dragonfly preserve (though it is closed for renovations). At the Cape May Bird Observatory in New Jersey, the clouds of dragonflies passing through have at times been so thick that hawkwatchers couldn't see. So the observatory now offers guided dragonfly workshops.

It has dawned on a few heretics that dragonflies are more colorful, more fiercely predatory and ultimately more interesting than birds. You can get close enough to them to watch what they're doing. With a net and good reflexes, you can also catch them and hold in your hand some of the most ancient and adept aerialists in the history of the planet—or at least you can swing and miss and know you have met your match.

One morning when I was just getting acquainted with the dragonflies around my New England home, I went to visit Virginia Carpenter of the Nature Conservancy in Rhode Island. Four of us, armed with nets, were soon patrolling knee-deep down the Queen River, where the Conservancy is conducting a population survey.

Carpenter (p. 78), who is shorter than her net, wore her blonde hair braided in back. She has written a regional field guide to dragonflies, one of the few now available in this country. She's been chasing these insects for 15 years. This means she has roughly 299 million years of catch-up work ahead. The dragonfly has been evolving since sometime before the pterodactyls. Fossils show that in its glory days it had the wingspan of a crow. "There! There! *There! Gomphus!*" Carpenter yelled. She swung and missed. "Didn't get 'em."

The dragonflies made us all look inept. Lisa Barton, a Conservancy administrator I came to think of as "Lisa the Lunger," charged upriver with her net, plunging across the shallows and flogging the bushes as she sank in the mud. It was her first hunt, but she managed to catch dragonflies. About all I could catch were jewelwing damselflies. They were everywhere, with their velvety black wings and metallic green bodies.

Damselflies are generally smaller than dragonflies, Carpenter explained. They are comparatively weak aviators, fluttering almost like butterflies, whereas their dragonfly cousins cruise like helicopter gunships. When perched, dragonflies spread their four wings out to the sides; damselflies almost always fold their wings up over the abdomen. Dragonflies are also distinguished by huge wraparound eyes; in many species, the eyes meet in a seam at the back of the head. Damselfly eyes are more widely spaced, like a hammerhead shark's.

This stretch of the Queen River was narrow and gravel-bottomed, rushing quietly through the woods. I stood

in the water, towering over a grassy patch where jewelwings danced in the midday sun. The peaceable setting made their lives seem carefree and inconsequential. I caught one, then let it fly off my hand, and my entire being was suffused with the warm feeling I have come to recognize as the Jolly Green Giant syndrome: me big strong fellow, likeness of God; you little pissant. Yea, truly, I was green in the ways of the odonates.

Carpenter spotted a couple of jewelwings in a dogfight just above the surface. "You see those two males fighting? They both like the same female. She's sitting on the grass. They're very aggressive. And look over there—that's quite a courtship dance between a male and a female." I watched the males bully each other, making dizzy loops and spreading their wings as if they could puff themselves up to grizzly-bear size. The intensity of their lives began to dawn on me.

For a male damselfly, a suitable perch overlooking a few square feet of water is a territory. Defending it against relentless male competition is the best way to get a mate. If he can hold a choice breeding site, the male may become what animal behaviorists call a "super stud." Females will dawdle past, sultry and coy. Some scientists call this a "Lolita-style soliciting flight."

To court a female, the male faces rakishly away on his perch and trails his back wings down like a cape. He then lifts his hind end and shows off his colors. She presumably gets the message. By coincidence, the jewelwing (*Calopteryx maculata*) is the species in which a Brown University researcher named Jonathan Waage discovered the bizarre details of what happens next.

Before the male even gets started, he must, in effect, have sex with himself, transferring sperm from a storage reservoir at the tip of his abdomen to the copulatory complex at the base of his abdomen, near the thorax—a procedure otherwise unknown in insects, though it is common among spiders. During mating itself, the male latches on just below the female's head with the tow-truck apparatus at the end of his abdomen. He clutches a blade of grass with his legs and holds himself cantilevered out, supporting them both. She wraps her legs around his hind end and bends her body under his in a sort of loop, until her own hind end connects at roughly his midsection. Some species commonly fly in this "wheel" position, and it can be a romantic sight. Calico pennant dragonflies actually have a string of valentine hearts down the length of the abdomen, red in the male, honey gold in the female.

But Waage demonstrated that sexual aerobatics are the least complicated part of mating. During copulation, the male makes regular undulating movements of the abdomen. By dissecting couples killed in flagrante

Immature dragonflies are deadly hunters. A larva waits for a mosquito wiggler (top, left) to stray into range, then seizes it (bottom) with a retractable lip. Above, a larger European larva devours a froglet.

delicto, Waage discovered that these undulations are not geared primarily toward insemination. Instead, they represent a methodical effort by the male to root out the sperm of any other males who have previously mated with the female. The male organ is equipped, like a Swiss Army Knife, with an array of attachments minutely evolved for this task. Waage found that jewelwing males were 90 to 100 percent effective at removing the sperm from previous matings. Thus the male can be certain that the eggs the female deposits in his territory will be his own offspring.

But males being males, doubts linger. Anyone who has spent time at a pond will have noticed one dragonfly flying with another in tow. In my ignorance, I'd always assumed they were enjoying some form of nonstop romance, an odonate waltz, round and round the pond. In fact, tandem flying is a form of desperate male clinging, called "contact guarding." The male hangs around lest another male swoop in and do unto his sperm as he has done unto his predecessors'. In some species, the male merely hovers possessively during egg-laying. In others, he remains attached and seems to swing his bride like a golf club as she pitches forth her eggs. The female presumably puts up with this because he protects her from the even more tiresome attentions of other would-be suitors. She gets 12 to 15 minutes of undisturbed egg-laying, versus 2 minutes on her own.

The afternoon grew fat and hot, and the dragonflies zigzagged high overhead. "Look up there. It's a bunch of *Epitheca princeps*," said Carpenter. "It's a big monster, two or three inches long. We call it 'the prince.' It's a beautiful thing. Look at them just cruising around, having a good time, picking off deerflies. There's a squadron of them. Come to mama," she begged, raising her net. They dipped and banked but kept their distance, and by midafternoon, having aggravated banged-up knees and bad backs with our log climbing and our Lisa-lunging, we abandoned the hunt, dreaming of beer and ibuprofen.

Despite their reputation as aerialists, dragonflies spend most of their lives underwater. In the larval stage, typically lasting one to three years, they are drab and, at a glance, unimpressive creatures, sprawling amid the underwater foliage or on the bottom. But they are also the scourge of all pond scum. A friend writes that as a boy he used to bring home a murderers' row from a local pond—water tigers, diving beetles, water bugs, back swimmers and of course dragonfly larvae. He'd start with 20 things in his aquarium, "and after a week there'd be only one thing, and it would be fat."

Having just emerged from its larval skin, a green darner waits for its body to harden and gain strength.

The original rearguard action

Dragonfly larvae have a secret weapon to make sure that they are the one fat survivor: anal jet propulsion. They use the rectum to breathe water in and out across gills in the abdomen, and they are capable of ripping off a blast that will rocket them two or three inches through the water and away from any predator. Damselflies are too refined for this happy talent; they have a more delicate three-finned tail assembly.

One day I watched a damselfly larva scanning the underwater world with its big, wide-set yellow eyes. When a quarter-inch minnow approached, the eyes followed it, then the head turned, then the entire body slowly turned around. The larva yearned for that fish, the way a cat longs for a moth dancing just out of reach.

Dragonflies and damselflies both possess a killer lip. Normally it stays folded underneath the head, where it looks like a beard, one-third the length of the body. The larva can unfold the lip and shoot it out in a hundredth of a second, seizing a fish or tadpole with two grasping hooks at the tip. Immature mosquitoes are among the favorite prey. In Southeast Asia, where dengue fever remains a threat to public health, scientists recently discovered that dragonfly larvae are a good remedy. Two

Configurations of smoke blown around a dragonfly in a wind tunnel show how turbulently the air flows by the insect's flapping wings. The vortex created over each wing can exert the uplift of a miniature tornado.

of them in a water storage container killed all larvae of the mosquito that causes the disease—up to 800 individuals in a week.

When they're done eating pests, dragonfly larvae do something chemical pesticides often don't: they go away, and in great style. The larva climbs out of the water and splits down the back. Out of the skin a dragonfly emerges. While still soft and glossy, the dragonfly pumps itself up to stretch out its wings and abdomen, till it is often triple the size of the larval skin.

This is the most vulnerable stage in the dragonfly's life. At the Slaughter Ranch, I watched one gather its strength on some debris a few feet offshore. Then a phoebe swooped down from a willow and gobbled it up for breakfast. But once it dries and hardens into its adult shape, a healthy dragonfly can usually outwing almost any predator.

When dragonfly enthusiasts meet over beer, the talk invariably turns to how some prized dragonfly has eluded them and to new schemes for evening the odds. "I asked for a gun for my birthday," I heard an insect taxonomist remark one night. "I could load the shells with dirt and bring one down."

Richard Conniff's book Spineless Wonders: Strange Tales From the Invertebrate World, *published by Henry Holt & Co., will be available this November.*

"I know hunters who have trouble hitting a duck," someone replied, "and you think you're going to hit a dragonfly?"

"How you gonna retrieve the specimen?" another doubter wondered.

"You need an odonate dog."

"If you do hit a dragonfly, you'll blow it to pieces."

"All I need are the genitalia," the taxonomist declared triumphantly, genitalia being the key to species identification. There was a pause during which everyone present considered the odds against training a dog to retrieve dragonfly genitals. Then the conversation shifted mercifully to other schemes.

Capturing dragonflies alive and unharmed used to be a common summertime game for boys in Japan. They tied small weights on each end of a silk thread, then threw the device in the air in front of a passing dragonfly. With luck, the dragonfly confused the weight for a mosquito, attacked, and got tangled in the thread. Not long ago I chose a more newfangled form of child's play, strapping a couple of Rambo-style bandoliers across my chest and wading out into a local pond carrying a Super-Soaker XP 95 water gun loaded with soapy water. I'd been told this would temporarily foul the dragonfly's flying gear. Unfortunately, you must hit the dragonfly first. Every dragonfly I fired on saw it coming and ducked. I soon had a slick of soap bubbles spreading

Still water reflects the mirror image of a common European meadowhawk pausing for a moment's rest.

out ominously around me. Feeling like the captain of the Exxon *Valdez,* I quit and went home to read up on what makes dragonflies such elusive aviators.

Dragonflies are among the fastest insects on wings, having been clocked at 35 miles an hour. They can lift more than double their own weight, an achievement human aircraft cannot approach. They can take off backward, accelerate at warp speed, execute an unbanked turn in forward motion as if on a pivot, come to a dead stop in an instant, hover, and even somersault in the heat of combat. The U.S. Air Force has put them in wind tunnels to see how they do it, and despaired.

Dragonflies outpower all other winged insects; one-third to one-half of their body mass is devoted to flight muscles. But their flight system is one of the most ancient on earth. Each of the four wings is like a seesaw with an off-center fulcrum. One set of muscles attaches to the inside end. The other set angles out to attach to the wing on the outside of the fulcrum. These muscles rock the wing up and down, achieving a modest 30 to 50 beats a second.

On insects built along more modern lines, like the housefly, the main flight muscles are not attached directly to the wings at all. Instead, the first muscle set pulls down on a plate in the insect's back, causing the hard body surface to buckle inward and forcing the wings into their upstroke. The buckling simultaneously stretches the second muscle set, connected at the front and rear of the dorsal plate. These muscles then automatically contract, causing the body surface to pop back into its normal position and forcing the wings down. Houseflies thus manage 200 wingbeats a second.

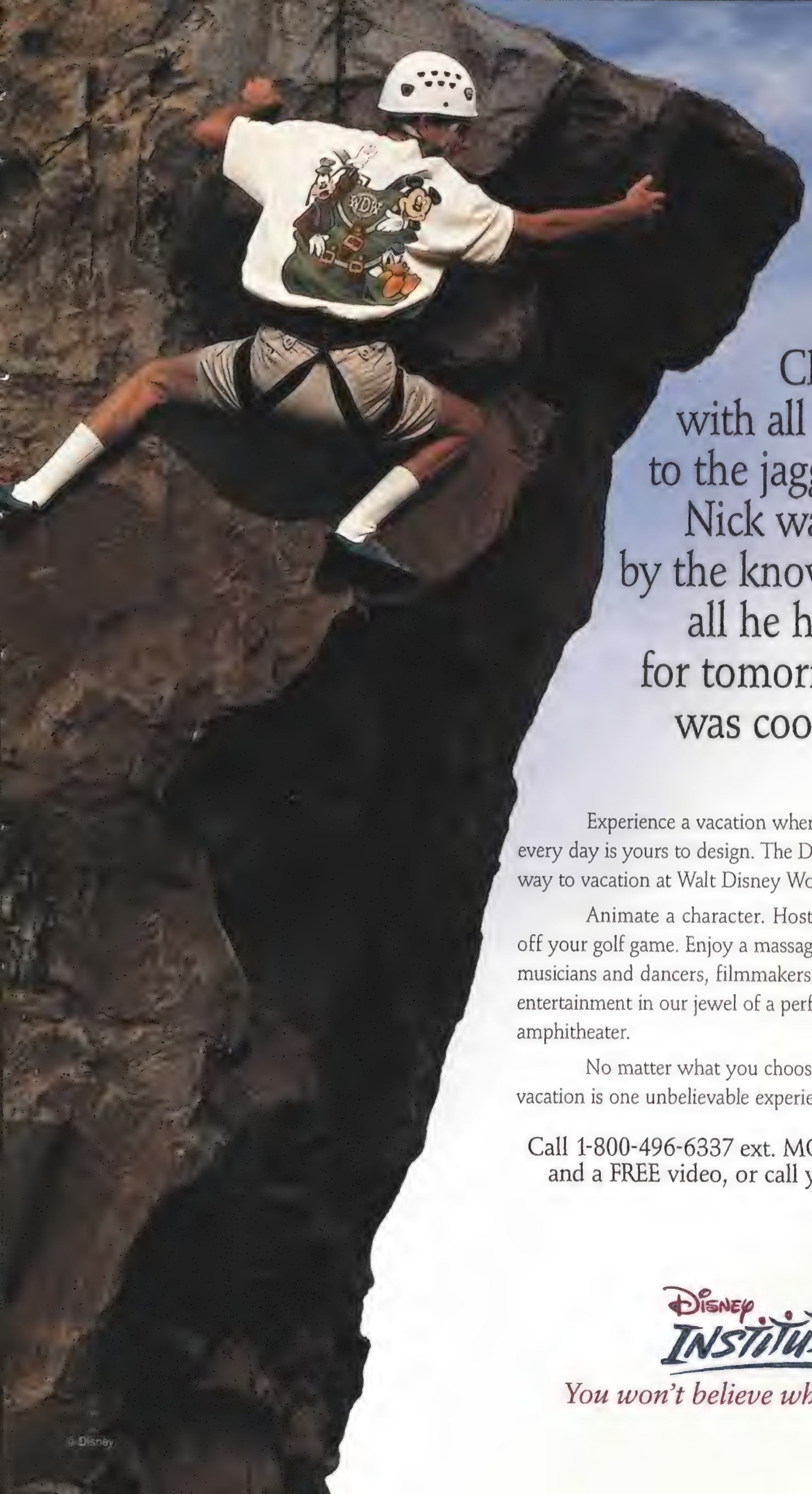
Why dragonfly wings have an edge

But dragonflies routinely catch and eat houseflies, not the other way around. So what gives? The dragonfly's wings, which look like brittle cellophane, are in fact intricately cross-braced, top-to-bottom and front-to-back, and it can bend them to produce almost any aerodynamic effect. It can beat all four wings in unison for quick bursts, or it can beat the front and back pairs out of phase for a slower, weaving flight pattern. Fine hairs on the upper wing surface, combined with the stubby antennae between the eyes, allow the dragonfly to read and control minute changes in airflow. On the leading edge of the wings, small thickened areas, called stigmas, may act as stabilizers.

All these adaptations make dragonflies masters of what aviation engineers call unstable aerodynamics. Whereas we strive to minimize turbulence over the wings of our aircraft, the dragonfly's wings deliberately generate and exploit turbulence. Wind tunnel tests of dragonflies showed a vortex over each wing, with the uplift of a miniature tornado.

Not only can the dragonfly outmaneuver almost anything else on wings, it can see better, too. Each of its bulbous wraparound eyes contains up to 30,000 lenses, and its field of vision extends to nearly 360 degrees. Dragonflies sometimes do things that call their visual acuity into doubt. For instance, species that have evolved along rivers often patrol highways instead, or they may lay their eggs not in a shimmery pool but on the polished hood of a car. But they can see other dragonflies and go to them from a distance of almost 100 feet. A dragonfly perched in the grass can spot a gnat three feet away, zip out, grab it, then retreat to its perch to eat, all in just over a second, and do it 300 or 400 times a day. But let's cut to the bottom line: they could see me coming from a mile away.

Having failed thus far to catch a dragonfly, I headed out to the New Mexico-Arizona border, where the Dragonfly Society of the Americas was having its annual meeting. The spiritual leader of the group, Nick Donnelly, is a 63-year-old geology professor who looks like a parish priest. His white hair is scuffed up carelessly over a pink scalp. When he speaks, he casts his small blue



Clinging
with all his strength
to the jagged rock,
Nick was comforted
by the knowledge that
all he had scheduled
for tomorrow
was cooking class.

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Wading in a Rhode Island brook, dragonfly expert Virginia Carpenter gamely tries to down dragonflies with a stream of soapy water. Soap is supposed to mess up the insects' flying gear—if you can score a direct hit.

eyes heavenward, or closes them and purses his lips, as if almost tasting some ineffable dragonfly truth.

Donnelly started out as a birder, but he lost his faith when he perceived that arguments over bird sightings tended to be won by loud voices, not hard evidence. Moreover, most of the species that birders in this country argue about were already known and studied more than a century ago. "Dragonflies," Donnelly told me, "are an odd combination of beautiful things, a number you can master—about 500 species in North America—and the chance to discover something new. In North America, we're still finding on average one new dragonfly species a year. You just can't do that in the bird world or the butterfly world."

A dragonfly convention consists of 40 or 50 lungers and thrashers armed with nets who meet in a motel parking lot early on a Saturday morning, then scatter across the landscape. They reassemble at night and speak a language known only to themselves. When someone asks how big a species is, the speaker does not reply in inches or even centimeters. "About as big as *Erythrodiplax connata*," he says, and everyone nods. Another speaker describes how he nearly died of hypothermia climbing a mountain in Papua New Guinea and brought one prize back down—"a weird montane *Ischnura*, densely hairy and kind of fat."

Almost no one gets paid to study dragonflies, which do not damage crops, cause disease or otherwise call themselves to the attention of agencies that fund research. So what we know about dragonflies is often the work of amateurs risking hypothermia in New Guinea or getting their brains baked in the Arizona sun, usually on time stolen from their jobs, their families or both.

Most of the members of the society are avowedly dragonfly collectors, not merely dragonfly watchers. They go out equipped with glassine envelopes into which they carefully tuck the dragons and damsels they catch. They spend their nights preserving specimens in acetone, straightening abdomens and untangling thorny legs for a museum-standard presentation. Often the only way to know for sure what species you are looking at is to collect it and examine it under a microscope.

All of biology begins with collecting. You have to know what things are before you can begin to understand anything else. "We're trying to do serious science," Steve Valley remarked one day when we were out flailing our nets over the surface of New Mexico's Gila River. "I do a lot of behavior studies, flight season things, geographical studies for my state. I'll mark dragonflies and go back to see what territory they're defending the next day and get longevity statistics."

The society is currently assigning common names to every odonate species in North America. Like bird names, they are appropriately colorful—gilded river

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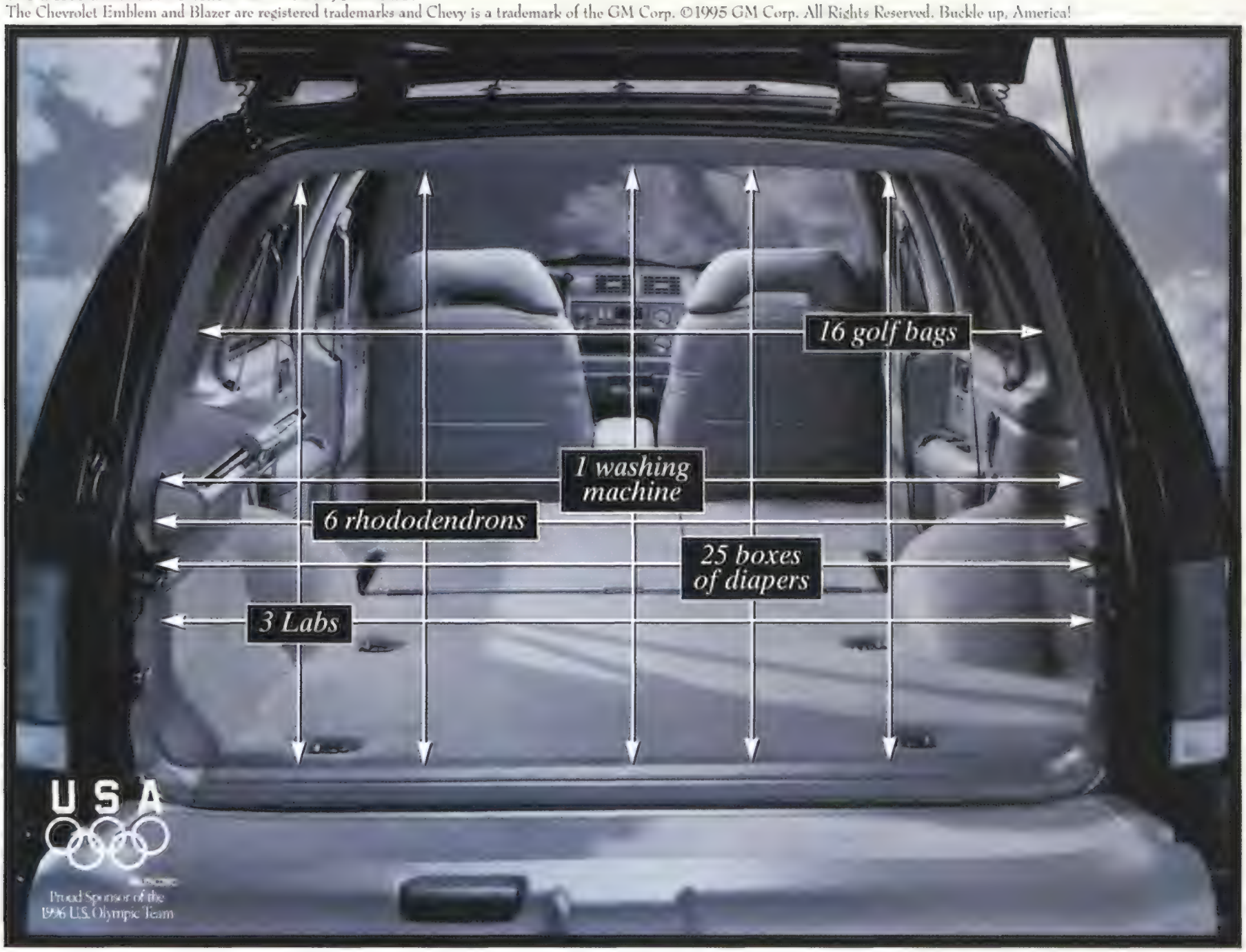

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Preserved in exquisite detail, dragonfly fossil found in limestone deposit appears eager to take flight again.

cruiser, beaverpond baskettail, sandhill bluet, cardinal meadowhawk. But people like Valley worry that the birders may bring their hands-off ethic with them. The note of defensiveness in his voice is a response to people who frown on collecting any form of wildlife.

Dennis Paulson, a museum director in Tacoma, Washington, who is both a birder and a dragonfly collector, acknowledges that certain species—those that are threatened by human activities or restricted to narrow habitat ranges—should not be netted. Aside from that, he says, collecting is harmless. "Every dragonfly you catch is going to die very shortly anyway. If you're worried about populations, and not individuals, there's no way in hell we could collect every dragonfly in a population. We're not good enough, we're not out there long enough and there aren't enough of us."

But there's nothing wrong with letting a dragonfly go, assuming you can catch one in the first place. So I took my first swings on the Gila River at a dragonfly named *Brechmorhoga mendax*. I'm not sure why scientists gave it that name, which means "liar," except that it never went where I thought it was going to go when I started my swing. The other collectors advised me to wait till *B. mendax* was already flying past, then swing from behind where its vision is weakest. But you cannot really blindside a dragonfly. I tried to come in overhead, flapping the net down on the surface, a technique called "pancaking." I caught a fish. It was not a keeper.

I sought out the wisdom of an old master, Steve Valley, who said, "I miss most of the ones I swing at, too. They've been doing this for a couple hundred million years, and nobody beats 'em for maneuverability. Think of all the visual data they've got coming in, and the flight corrections, and the stopping on a dime and then just disappearing. I'm out there because I enjoy being outdoors, and I love watching dragonflies fly."

So I relaxed a little. Next day, I was alone on the Gila downstream from an area where the tan-and-yellow cliffs stood in columns like massive tree trunks. I was shin-deep in a riffle when a dragonfly the color of a flying goldfish cruised through at eye level. I watched it come and go, always just out of reach. It was lovely.

Then it came straight at me and I crouched in readiness. It was like a baseball pitch, Mother Nature on the mound. The ball had incandescent red eyes that seemed to glare and taunt from 50 feet out. It moved like a slider and a curveball and a change-up all combined. There was every possibility that it would stop six inches beyond the maximum extension of my net and zoom straight back in the opposite direction. I held the sock of the net against the handle, to minimize drag. The dragonfly kept coming. I swung, letting the white netting free, and listened to it whistle through the air. At the end of the swing I flipped the handle with my wrist so the sock hung down over one side. The dragonfly was buzzing angrily within my net.

I'd like to say I let it go. But I had faced it eyeball to eyeball in its own territory and won, and I felt that it was mine. The scientist in me (or maybe it was just the hunter-gatherer) asserted itself. I found that I could catch different dragonflies with different strokes, and by day's end I had filled a dozen glassine envelopes.

The preservation process was a disappointment. The acetone held the enameled colors of the thorax and the abdomen reasonably well. But it could not preserve the magnificent eyes. They went from opalescent pools, in my favorite specimen, to the flat, opaque color of rust.

I expect I will catch and keep other dragonflies. There are a couple of river estuaries near my house that have never been surveyed, and an entomologist at the state university wants to know what's there, with sample specimens. But I also love catching them to hold in my hand for a few moments. The eyes are misty and deep, like a fortune-teller's ball. Colors flash across them. Black patches like pupils seem to stare back, as if considering who I am and where I stand in the great scheme of things. Looking into those eyes is like looking back in time. I remember that dragonflies were here before some of our ancient mountains. They witnessed the coming and going of the dinosaurs, the arrival of those second-rate aerialists, the birds, and the evolution, just yesterday, of the human race. When I let a dragonfly go now, it no longer makes me feel like a giant.

Distinctive bull's-eye pattern on its forehead gives a common green darner the uncommon look of a cyclops.

By Sam Connery

Taking liberties with an American goddess

Mocked, martyred and marketed, our favorite statue is still hard at work "enlightening the world"

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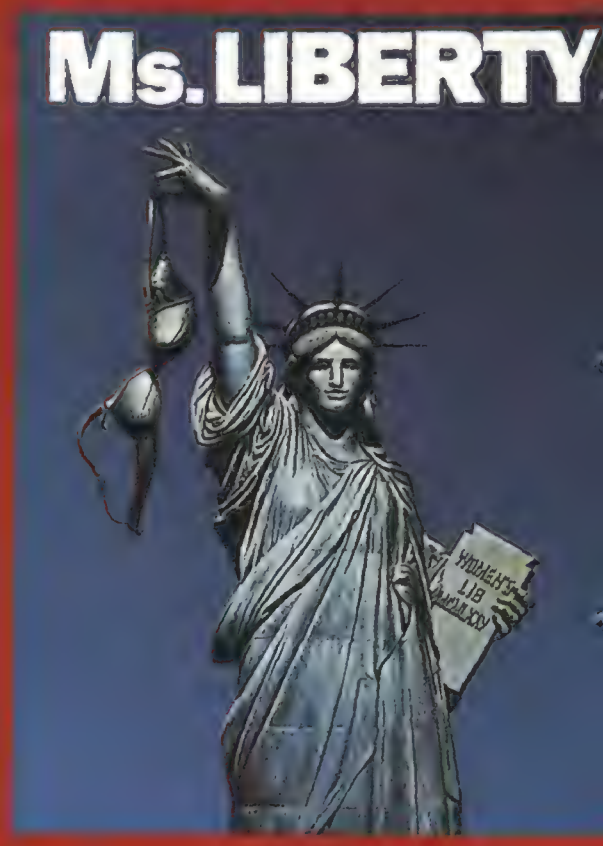
It was, one reporter wrote, like "a hundred Fourths of July"—the air ringing with tugboat whistles, shouts and marching bands. A speech by New York's Senator William Evarts could hardly be heard; when he paused, an impatient crowd burst into applause. Perched high above, inside his 302-foot masterpiece, French sculptor Frédéric-Auguste Bartholdi heard the cheers and prematurely let loose a tricolor veil from the stern face of his creation, *Liberty Enlightening the World.*

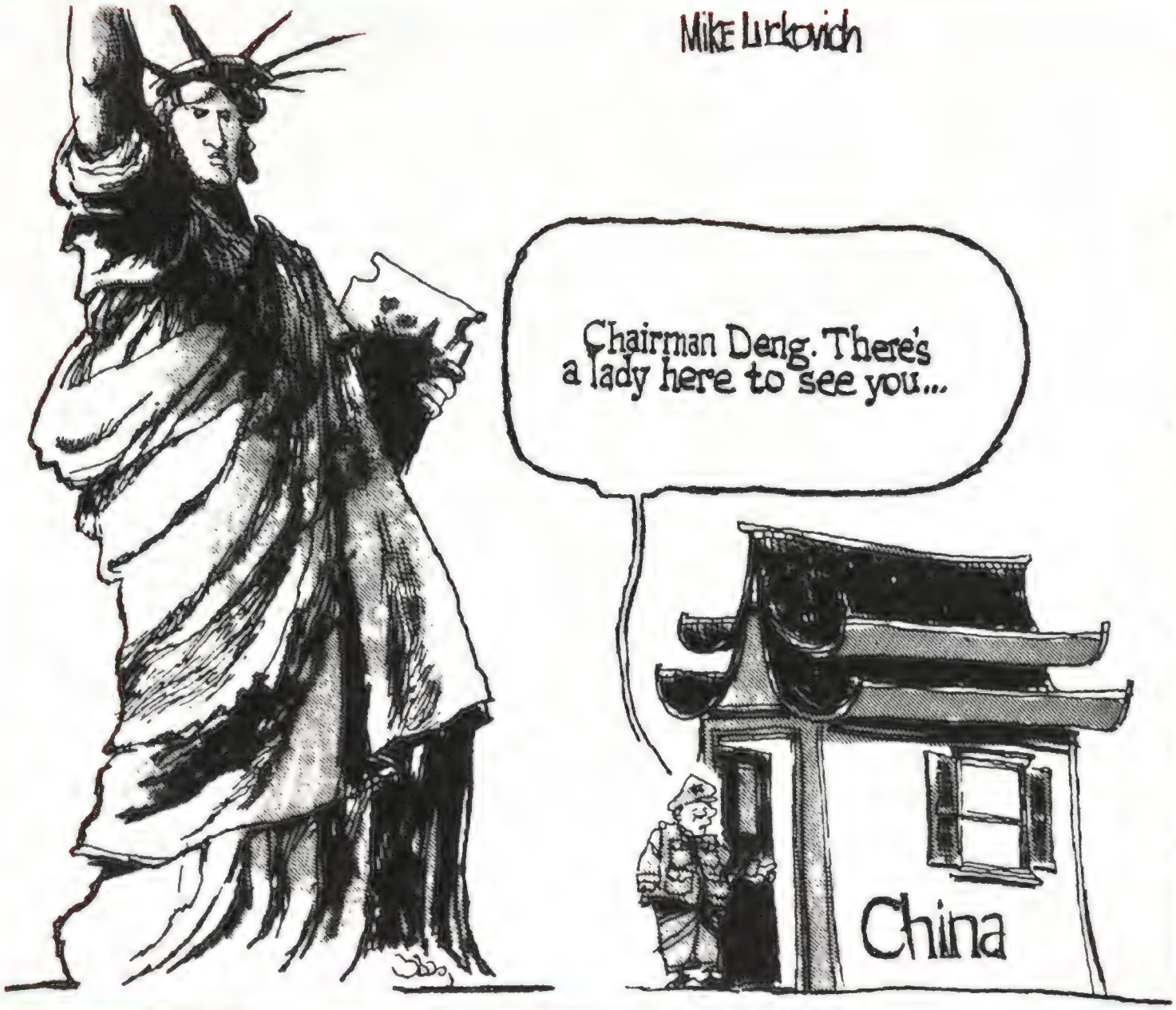
Even before that day in October 1886, the Statue of Liberty was seized upon as a national symbol, more identified with America than Britannia has ever been with Britain or Marianne with France. Bartholdi, showing remarkable foresight, secured the rights to his design—and it surely paid off. Greeting shiploads of new immigrants, Liberty was the obvious choice to illustrate guides to citizenship. On the assumption that patriotism sells (how times have changed!), she was used to pitch products from cigarettes and sewing thread to wafers (opposite) and to urge young men to get into uniform, if only as Boy Scouts (left). She has been saluted and skewered by editorial cartoonists, mocked and martyred, admonished and admired, and even, at times, disrobed (p. 84).

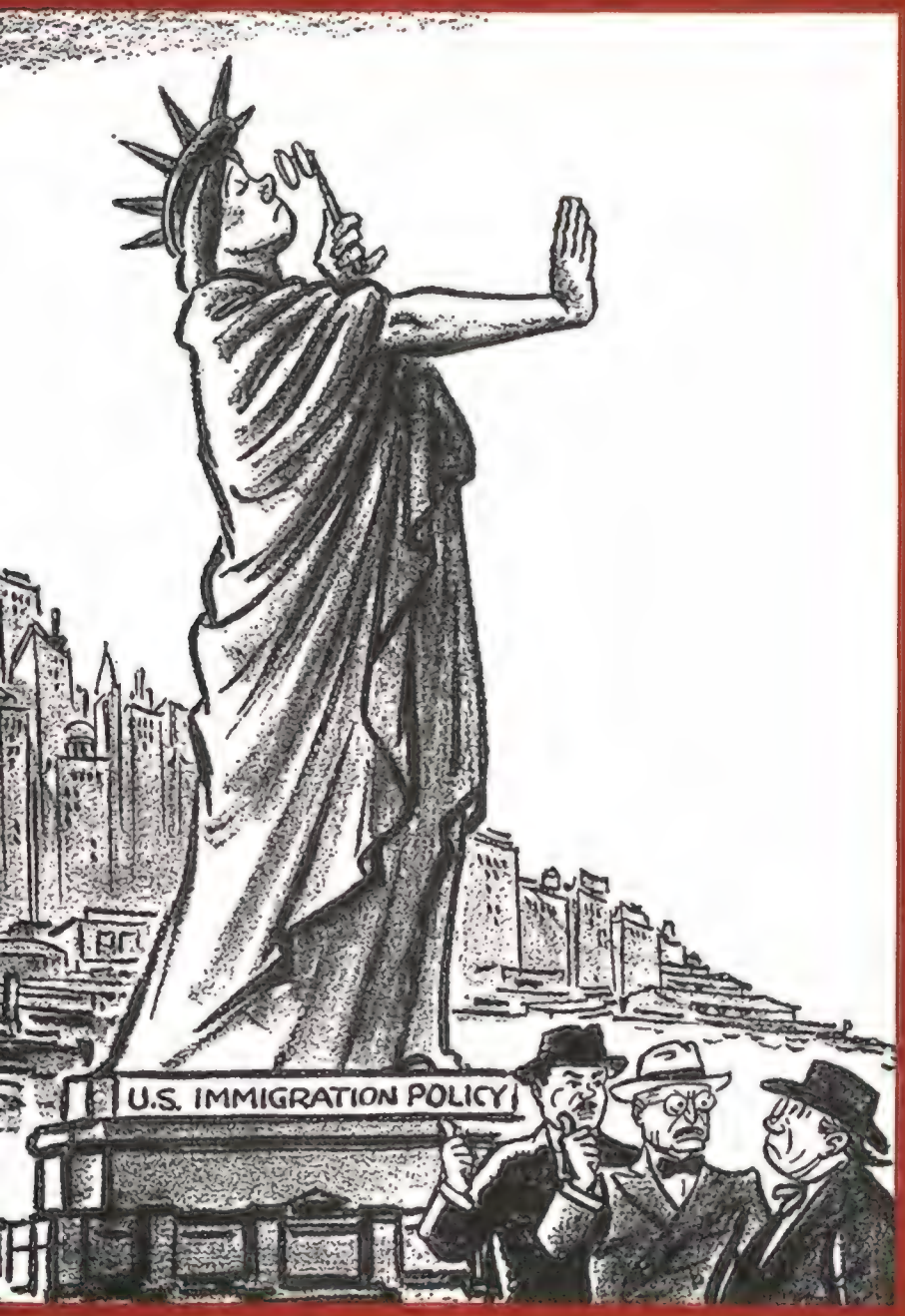
But despite wanton exploitation of the good lady, she remains the potent symbol of American-style freedom and inclusiveness Bartholdi had in mind. In May 1989, pro-democracy demonstrators in China wheeled a 33-foot Styrofoam-and-plaster Liberty into Beijing's Tiananmen Square. Tanks easily ran the "Goddess of Democracy" down—but the hope she represented has proved more durable.

Liberty
FEEDING THE
WORLD
Holmes & Coutts
FAMOUS
SEA FOAM
WAFERS
NEW YORK

A rebellious "Ms. Liberty" shed a measure of decorum on a 1975 *Mad* magazine back cover (right), while having a little fun with Women's Lib. In 1989, taking a deeply disapproving stance (below), she paid a surprise visit to Chairman Deng Xiaoping in the People's Republic of China.







Blizzards last winter—though not truly "monumental"—dumped enough snow to impress even the most jaded New Yorker (above). In a 1946 Herblock cartoon (left), most jaded of all is the Mother of Exiles herself, posing as postwar immigration policy and turning up her nose at "huddled masses."

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6

By William Lanouette

Olympic rowing—you need both grace *and* guts

And a day job. There will be no 'Dream Team' of pro rowers in Atlanta; that's because in 1896 rowing for profit was banned in Boston

"A *sixth* heron!" I gasp, breathing hard and reaching my oar for the next stroke. "That's a new record!" We're skimming along the Potomac, between parks on the Virginia and District of Columbia shores that give leafy refuge to rowers—and to birds. Great blue herons nest here, and if you rise at dawn to row upriver, silently, before the din of outboards revving, you may encounter these stately creatures. Seeing one or two on a morning row is a treat. Spotting six is sensational.

I'm in the stern of a pair-oared shell, a 30-foot racing craft no wider than my hips. In the bow is Ralph Oser, who learned to row at a military academy in the '60s, about the time I did in college. Now we row on weekends from the Potomac Boat Club, just below Georgetown University. In the Washington bureaucracy, Ralph and I are adversaries: he's a lawyer for the U.S. Department of Energy, which I investigate regularly for Congress' watchdog agency, the General Accounting Office. But on the river we're a team, intent on coordinating our next stroke; a bad move with either oar could flip us into the river.

Poised unstably just above the waterline and facing astern, we have minimal contact with the delicate, one-sixteenth-of-an-inch-thick cedar shell: we lace our feet

A race of eight-oared shells with coxswains (who steer and act as on-water coaches) is the ultimate in rowing; here, an international regatta in Lucerne.

Photographs by Brian Hill and Joel W. Rogers

into shoe-like "stretchers" just above the keel, and we sit on seats that roll on metal tracks—giving each stroke the full power and leverage of our legs, backs and arms. We each grip a single 12-foot oar that pulls the shell forward during the "stroke," then acts like a high-wire artist's balancing pole as we "feather" the blade flat above the water and roll gently toward the stern for the "recovery." During the stroke, the oars flex and spring back, and we can feel the boat rush forward. Even at a leisurely 20 strokes a minute, our lungs ache for oxygen, our arms and legs become sluggish. We're burning more than 1,000 calories an hour—and this is just for *fun!* In a race the stroke rate can more than double, making rowing one of the most demanding of sports, both mentally and physically. To do it well takes both grace and guts.

"You'll pass out before you die"

"Our coach tells us we have to die three times during a race," says Mary McCagg, from Kirkland, Washington, who will row this month in the American women's eight-oared shell at the Olympics. "We just hope it doesn't happen to everybody at once." Not to worry, says my GAO colleague, Olympic hopeful Michelle Knox Zaloom. "Just remember, you'll pass out before you die." Since the fall of 1992, Knox Zaloom has prepared for these Olympics by rowing 12 to 15 miles on the Potomac every morning before work. She has lifted weights at lunchtime, then returned to the river after work to "pull" another 10 to 12 miles. Since February, she has been rowing and lifting full time. "I wish I could make a living at it," she sighs.

But she can't. There will be no "Dream Team" of professional rowers at the Olympics. That's because 100 years ago, soon after the first modern Olympic Games were held in Athens, professional rowing was being banned in Boston, the upshot of America's first major sports scandal. Greed for lavish prize money had led some oarsmen to throw races or sabotage their rivals, and crooked betting pools soured the public's faith in the sport. Once the Boston City Council banned pros from its annual regatta in 1896, pro rowing declined rapidly and soon vanished. It was the end of an era.

In the decades following the Civil War—before baseball, boxing, football or basketball became big business—competitive rowing, or "crew," was America's richest and most popular spectator sport. Fans by the thousands lined rivers and lakes around major cities, jammed aboard excursion trains and steamships, and wagered eagerly on the famous oarsmen who raced for prizes equaling as much as $100,000 today. Like pro stars now, the best rowers were featured in newspapers and magazines and on trading cards; prints by Currier and Ives, and illustrations in *Harper's Weekly* and *Leslie's*

A show now at the National Gallery features Thomas Eakins' rowing pictures; here, *The Biglin Brothers Racing.*

A time when modesty mattered most: the Wellesley class of 1889 crew actually rowed in this bulky garb.

Oarsmen were sports heroes until dirty tricks and rigged betting ended rowing's heyday, c. 1860-80.

The Biglins (John, at right, and Barney, rear) were superstars whose "four" earned up to $6,000 a race.

Illustrated Newspaper brought race-day scenes to readers across the land. Two of the era's most celebrated champs, John and Bernard (Barney) Biglin, were also portrayed by American realist Thomas Eakins. (Through September 29, all of Eakins' extant rowing paintings and drawings are being shown together for the first time at the National Gallery of Art. They travel to the Yale University Art Gallery in October and to the Cleveland Museum of Art in February.)

Knowing little or nothing of the lost world of pro rowing and its working-class heroes, most people today assume the sport is reserved for the Ivy League male elite. True, America's oldest intercollegiate contest is the annual Harvard-Yale boat race, begun in 1852. And true, East Coast colleges were among the first to adopt rowing from England. But rowing has never been entirely elitist or strictly male. Young farmers from the University of Massachusetts Agricultural College at Amherst shocked all the private schools by winning the first multi-college regatta in 1871 by 14 boat lengths, and women rowed even before their first club was founded in San Diego in 1891. In this year's Olympics, there are eight events for men and six for women, involving six kinds of boats. All racing boats are called shells; "sweep" rowers use one oar and "scullers" use two. Sweep boats come in pairs, fours or eights; sculls are singles, doubles or quads.

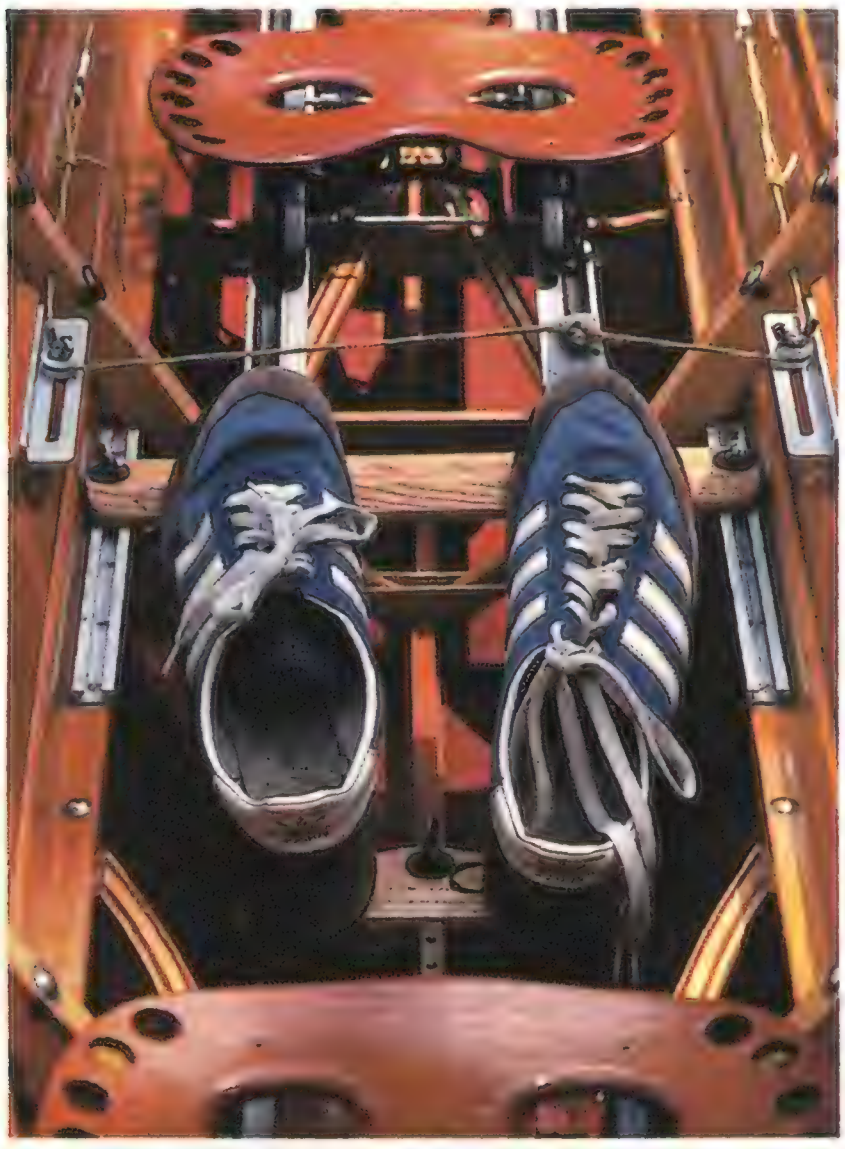
Although once made of fine cedar—and in the 1870s, of pressed paper—racing shells are now fabricated from ultrastrong, ultralight materials such as carbon fiber, Kevlar and epoxy resins, and can cost close to $30,000. The naval architects and engineers who designed the yacht that won the America's Cup in 1992 have used computer-aided design systems to create a racing shell with a stiffer structure and reduced surface area. The first boat produced by their company—Resolute Racing Shells—is being tested by this year's U.S. Olympic men's and women's eights.

Rowing thrives, even on the Chattahoochee

Every year, all across the country, hundreds of regattas attract rowers, from teenagers to octogenarians. And, as it did back in the 1870s, the sport can still draw huge crowds. Boston's annual Head of the Charles Regatta, a twisting and crowded three-mile race, attracts nearly 5,000 competitors and more than a quarter-million spectators in the world's biggest one-day rowing contest. England's fabled Henley Royal Regatta, a five-day event, and the legendary Boat Race between Oxford and Cambridge also draw large numbers of spectators. TV coverage of rowing is sparse, but there are two films—*The Boy in Blue,* starring Nicholas Cage, and *Rowing Through,* based on *The Amateurs* by David Halberstam.

Rowing thrives not only on the Charles but also on the Chattahoochee, the Ohio and the Des Moines—with

A bouquet of oars exemplifies the colorful pageantry of Olympic rowing. Sliding seats and special shoes attached to the boat help rowers maximize leverage.



huge regattas each year on Town Lake in Austin and Mission Bay in San Diego. And rowing isn't just for preppies and jocks; community groups abound. An organization in Oakland is working to introduce the sport to inner-city kids; there's at least one club for gays and lesbians; and another group, Martha's Moms, founded in Seattle by eight women old enough to be their coach's mother, now has 50 women members and a string of victories, including the Head of the Charles.

Although none of them are making big money at it, the men and women training for the Atlanta Games must devote as much time and effort as the 19th-century pros did. In 1872 the National Association of Amateur Oarsmen (now the United States Rowing Association) was founded to distance itself from professional rowing's commercialism, but "the paradox," says Steven Segaloff, coxswain of the U.S. Olympic men's eight-oared crew, "is that rowing is steeped in tradition, and likes to claim it's the last amateur sport. But these days we've got to train full-time. If we didn't, we'd get trounced."

As coxswain (pronounced "cox'n" and often shortened to "cox" by rowers) Segaloff sits in the stern and steers the 58-foot shell. He also cajoles his crew through grueling hours of practice and the excruciating five or six minutes it takes to race 2,000 meters (about one and a quarter miles), today's standard course. The coxswain also directs the race strategy and the pace for various segments. He or she must have the bark of a drill sergeant but—crew synchronization being of utmost importance—the team-building skills of a den mother. Physique also matters, of course. Rowers need to be tall and muscular; coxswains need to be short and lightweight.

For most of this century, the United States excelled in Olympic rowing, winning gold medals nearly every year. Then in the '60s, the tide turned as European and Eastern Bloc teams took over; the U.S. men's eight won its last Olympic gold in 1964. But in the '90s, American rowers have won 36 medals at the World Championships, and 3 at the Barcelona Olympics. At the Atlanta Games, both the American men's and women's eights stand a good chance of medaling; the women have already won this year's Lucerne regatta.

For this Olympiad, Mike Spracklen, the coach for the American men's eight, has combined an emphasis on traditional technique (the grace needed to "swing" a boat along) with a demanding regime of physical conditioning (the guts). "We're likely to be the fittest and the toughest guys there," he says. Both the American men's and women's eights have trained nearly full time since 1993 and raced each year at the World Championships. Since last fall the teams have worked out at national training centers: the women at Chattanooga, the men at San Diego. The athletes can apply for grants but these only cover basic expenses. Quite different from the pros of a hundred years ago.

Rowing nowhere fast: in midwinter, when the Charles River is frozen, rowers train at M.I.T.'s indoor practice tank. The artificial current and slotted oars combine to mimic the forces of a shell moving through water.

The rowers that Eakins painted were the sports superstars of their day; fans in the 1860s and '70s worshiped their favorite oarsmen. One Boston lad reveled in regatta days, when "all the rowing celebrities congregated, and . . . such men as Josh Ward, the Biglin Brothers, [James] Hammill, Walter Brown, and many others were revealed to us. Merely to catch a glimpse of them I have squirmed between the legs of a crowd and all but crawled over their heads . . . these were state occasions and occurred, alas, like angels' visits."

The telegraph spread racing results nationwide, and newspapers and sports magazines featured their own rowing correspondents. Boston, New York and Philadelphia were major rowing centers then. But so were Providence, Saratoga and Poughkeepsie, as well as Hoboken, Pittsburgh, Toledo and San Francisco. Fans packed into hotels and saloons on regatta days, crowded ferries and bridges around the racecourses, and bet eagerly, exulting in the prowess of their idols. They also bought handkerchiefs and pennants with the rowers' colors, and banners with their pictures.

Like today's pro sports, rowing then was serious business, dominated by investors seeking big money. Syndicates sponsored rowers and organized matches. They bankrolled the pros through months of intensive training, put up prize money and publicized each race. But most importantly, before the race, these syndicates formed betting pools that handicapped the rowers with odds that shifted right up to the shot of the starter's pistol. To wager, fans bought into the pools. The syndicates hoped to cash in by using their inside knowledge to set the most profitable odds.

To protect their investments, syndicates closely guarded their men and shells before and during the races. When James Hammill and Walter Brown rowed their famous 1867 sculling race for $4,000 and the Championship of America, some 50,000 spectators lined the Hudson at Newburgh, New York. The betting stakes were the largest in U.S. history, topping $250,000. To prevent any interference, a six-oared escort boat followed each sculler: in Hammill's, John Biglin flourished a pistol, as did Brown's helmsman—both threatening to shoot if anyone came too close to their man. To a chorus of huzzahs and curses, the scullers pulled to the midpoint of their five-mile race, where they had to round a stake and then return to the start. Caught by an ebb tide, Hammill's shell drifted against the turning stake, where Brown's shell rammed and sank the craft. The

William Lanouette, author of Genius in the Shadows: A Biography of Leo Szilard, The Man Behind the Bomb, *is writing a book about the Biglin brothers.*

Ruth Davidon and Cyrus Beasley will "pull" single sculls for the U.S. team at the Olympics.

backers argued fiercely, and crowds surged onto a dock, swamping it. In the end, the referee awarded the race to Hammill on a foul.

It wasn't reckless steering that finally sank pro rowing, however, but the rigged betting and dirty tricks—not during the Biglins' heyday (1860-76) but soon after. In July 1877, before a race against James Riley at Greenwood Lake in New Jersey, champion sculler Charles Courtney downed a huge lunch of mutton (the preferred training diet for rowers) and then ordered an iced tea. "That's the worst tea I ever drank," Courtney said after a sip. Suddenly he collapsed, complaining of stomach cramps and a burning throat, began sweating profusely and fell into a stupor. The odds-on favorite, Courtney was unable to compete, and Riley rowed the course alone to claim the prize. Operators of the betting parlors in Hoboken apparently knew about the poisoning scheme and shifted their odds to Riley even before Courtney's infamous lunch, prompting the *New York Times* to observe (ever so circumspectly) that "among the 'inner circles' of the betting fraternity" the events of the day "surprised no one."

Then, in 1878, betting-pool odds shifted suspiciously just before the race for the Championship of New England. The next year, Courtney contracted for three races with Canadian champion Edward (Ned) Hanlan. "Mishaps" at each race further discredited the sport. First, Courtney lost a race at Lachine, Quebec, in 1879, stopping to dodge boats that had drifted across the course at the finish. On the eve of their rematch, on Lake Chautauqua in New York, Courtney found his shell sawed in half. He refused to use a borrowed boat, and Hanlan rowed the course alone. The sponsor withheld the prize, but many Hanlan bettors prospered. During their final race, before huge crowds on the Potomac at Washington in 1880, Courtney suddenly stopped rowing after two miles of the five-mile course. It was only a matter of time until public disgust with such shenanigans and rower greed finished off professional rowing.

But in the early 1870s, before these events had tainted the sport, Thomas Eakins found in rowing all the energy and excitement of a vibrant, expanding nation. The show at the National Gallery, "Thomas Eakins: The Rowing Pictures," brings together 23 drawings and paintings that celebrate rowing at the peak of its glory. Nearly half the works depict John Biglin training or racing, and two ambitious oils honor a celebrated race that John and Barney rowed at Philadelphia in May 1872. Before crowds so huge that the police closed a bridge to prevent its collapse, the Biglins won the world's first professional championship for pair-oared shells.

"Rowing was an apt metaphor for all that Eakins believed in—rigorous discipline, self-knowledge, and complete harmony between mind and body," observes Helen Cooper, curator of American paintings and sculpture at the Yale University Art Gallery and the organizer of the exhibition. When Eakins, an amateur sculler himself, returned home to Philadelphia in 1870, after nearly four years in Europe, he saw in rowing the American egalitarian spirit in its purest form: a blend of intellect, precision and stamina that together could attain heroic ends.

Over the next three and a half years, Eakins put rowers in more than half his works, first depicting his high-school chum, amateur champion sculler Max Schmitt, then, in 1872, following the Biglins as they trained and

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raced on the park-lined Schuylkill. National celebrities, the Biglins were described in a Philadelphia newspaper as "both dapper fellows, about medium height, well formed, and with a very determined cast of countenance. . . ." As victors in almost all of their races, the Biglins met a press corps eager to lavish praise. John, said the weekly sports paper *Turf, Field and Farm,* was "endowed with great strength, presenting in appearance the perfect picture of an athlete." A student of anatomy, Eakins, too, appreciated the Biglins' appearance and worked meticulously to capture these muscular figures in their slender racing shell—making perspective drawings and studying how colors reflect on water. "A boat is the hardest thing I know of to put into perspective," Eakins later told students. "It is so much like the human figure, there is something alive about it. It requires a heap of thinking and calculating to build. . . ."

In *The Biglin Brothers Racing* Eakins portrays the Biglins' characteristically smooth yet powerful style. And celebrating the precision that pair-oared racing demands, Eakins did *The Biglin Brothers Turning the Stake.* At the race's midpoint, John, in the stern, calmly steadies the shell as Barney pulls the bow into line for their drive to the finish—and easy victory.

Eakins also sketched and painted John Biglin in his single scull. One paper deemed him "undoubtedly the best general oarsman in America. . . . As a physical specimen he is about as near perfect as can be found, every muscle standing out distinctly . . . his whole form very neat and compact." And a mind-set to match; in training, his disposition was said to be "decidedly savage." Another sportswriter called him a "tough, sinewy specimen of human mechanism." In those days, rowers were often described as "machines," "watch springs" and "pistons"—the marvels of industrial technology at the time.

John and Barney Biglin grew up in an Irish-American family of six boys in New York City and, with older brother James, started racing in impromptu $5 and $10 contests on the East and Harlem rivers. Soon they were earning up to a couple thousand dollars a race. Utter professionals, they trained six hours daily in season, challenging any and all other oarsmen; if they found no takers, they raced against tugboats.

By his mid-30s, Barney had turned to other pursuits,

Per rowing tradition, a Canadian "eight" tosses its coxswain in the drink after winning the gold medal in 1992 at Barcelona. Coxes prod rowers to their painful best; hence this ceremonial revenge.

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but John continued as a pro rower and coach; off-season he worked as a laborer and fireman. Applying his own fierce training regime, John selected what the *New York Tribune* called "raw beef and bloody bone giants" for the 1873 Dartmouth crew, then made them row at least 26 miles a day, and hike even farther. Despite this routine—some sportswriters said because of it—they lost badly.

Striking a balance between challenge and exhaustion isn't easy, and a modern-day John Biglin, Hartmut Buschbacher, coaches the U.S. women's eight-oared crew with a program that he hopes "won't kill them but will make them better and enable them to win even on their worst day." Buschbacher's East German women's eight won a gold medal at the 1988 Olympics, and he pushed the U.S. women's four to win a silver at Barcelona in '92.

As far as anyone knows, no Olympic rower has ever thrown a race because of betting, but the threat of equipment tampering remains. "If you don't think that the Olympics is peaceful warfare, you're foolish," warns two-time Olympic coach Allen Rosenberg, recalling the time at Tokyo in 1964 when someone cut the bolts on a rigger that supported one of the oarlocks. "You should post people in the boat bay," he says, "to make sure nobody fiddles with your boat or oars."

Though they enjoy little celebrity and minimal compensation, the single scullers who will represent the United States at this year's Olympics resemble the 19th-century champs in the time and tenacity that they devote to the sport. Ruth Davidon, 32, a third-year student at the Johns Hopkins University School of Medicine, has raced and sometimes beaten the best women single scullers in the world. Preparing for Atlanta she juggles training with studying for medical boards, which she plans to take in the fall. When rowing in Baltimore Harbor she has even emulated the Biglins by racing tugboats: "Not just for speed," she says, "but to stay ahead of their wakes. If you don't, you'll get swamped."

Single sculler Cyrus Beasley, 24, from Newburyport, Massachusetts, has a different concern: his own inexperience in a scull. He learned sweep rowing in college but began single sculling just two summers ago. At 6 feet 6 inches and 224 pounds, he displays awesome power but has sometimes flipped his scull because of sloppy bladework. So, in preparation for the Olympics, Beasley is focusing on his "hardly polished" style.

Generally speaking, champion rowers are tall. The advantage of height is that it provides extra leverage, allowing for an extra-long sweep of the oar through the water. But you don't have to be a giant like Beasley to be on the Olympic team. At 5 feet 3 inches and 102 pounds, Yasmin (Yaz) Farooq, 30, of Waupun, Wisconsin, is the perfect size to be a coxswain, which she has been for the U.S. women's eight since 1989. "The eight race at the Olympics is the ultimate in rowing," says Farooq. "First there's dead quiet, then a swish as the gates in front of the boats are lowered. At the word 'Go!' from the starter, suddenly coxes are shouting in up to six languages. With a burst of adrenaline, the crew starts off with a series of rapid strokes; there's lots of splashing and spray everywhere. All through the next six minutes I'm calling out instructions and motivation."

At the beginning "the stroke rate goes up and the cox gets excited," adds Mary McCagg. "Then we get excited. Then it's her. Then us. Then her. It builds like that." Farooq tracks the stroke rate on a rowing computer called a PaceCoach so she can quickly direct changes during the race. "We start at 45 or 50 strokes a minute," she says, "then settle down to between 36 and 40 for the body of the race—but with surges of 15 to 20 faster strokes to move on another boat. For the final 'sprint,' we row at 40 to 45. The team can't row at a high stroke rate the whole time—first they'd get so tired they'd get out of sync, then they'd puke." To gauge stroke efficiency and power, Farooq watches the rowers' bladework closely. "When they rip at the water on the finish of the stroke, for example," Farooq says, "they're slowing the boat down. It's then I give the crew a call to get back into rhythm."

Hearing these young Olympians talk about the coxswain's role led me to recall the days when, as a graduate student 30 years ago, I rowed in the London School of Economics Boat Club eight with a cox who was all drill sergeant. When training on the Thames by Kew Gardens, however, we knew he would always stop the shell at Syon House; an avid birder, he liked to pause and peer into the heronry there. It was the only break the little devil ever gave us.

Single sculls are ultrasleek, much like giant water bugs. But, only about a foot wide, they are very easy to flip.

By John F. Ross

Hardly a mouse or a molecule moves here without being noted

Photographs by Cameron Davidson

At a 2,600-acre research site near Chesapeake Bay, Smithsonian scientists are answering basic questions about how ecosystems work

Anyone can talk about their backyard with authority. In my case, I can discourse about when the crocuses will push up, the habits of chickadees and their attraction to my old rain pipe, and the shedding characteristics of my silver maple. Talk to Tom Jordan about his "backyard," however, and you will be amazed. Granted, the 2,600 acres of the Smithsonian Environmental Research Center (SERC) on the western shore of Chesapeake Bay are not exactly his, but he knows them far better than I or almost anyone knows their backyard.

When I step out my back door, I see the visible, the surface of the underlying reality. Jordan sees a nearly invisible world, a tangle of complex systems running at full throttle day and night. This energetic man in battered sneakers is no clairvoyant but a scientist. He grins as he tells me how the planet breathes, sighing gentle exhalations of gas from the soil, and how a tree is made out of carbon in the air we breathe. After a few hours with him, my own backyard looks distinctly different.

Jordan is not alone in his intense interest in this nondescript patchwork of fields, woods, marsh and estuarine waters. Eleven other senior scientists have also made it their business to know every detail about this parcel of waterfront land, a microcosm of neighboring Chesapeake Bay, the country's largest and most productive estuary. Saltwater meets fresh on SERC's campus, and wetlands soothe the divide between land and water. A "snapshot" of Maryland's coastal plain, SERC includes second-growth forest, abandoned fields and working farmland.

Over the past 30 years, this place—land, water and air—has been poked, prodded and measured by scientists, technicians, interns and volunteers. Despite our familiarity with Eastern deciduous forests and estuary ecosystems, we still have a lot to learn. The mechanisms we want to understand are largely invisible, and often fast-moving and microscopic or so large and slow-moving that they are difficult to detect. Often the clues to nature's workings are found where humans normally are strangers: deep underground, at the bottom of the estuary, in the canopy a hundred feet overhead.

SERC scientists are learning all the time. They've recently discovered, for example, a way to measure the impact of the increase in the ultraviolet component of sunlight as earth's ozone layer thins. The increased radiation slows photosynthesis in the microscopic plants known as phytoplankton, the bay's tiniest organisms. They've also found that trees soak up most of the acid in rain, and that a drop of rain may undergo enormous

Gary Peresta draws water sample from a chamber where marsh plants are exposed to high carbon dioxide levels.

chemical changes between the time it hits the first leaf and the time it hits the ground. Most importantly, perhaps, SERC scientists have documented how adjacent strips of forested land can protect streams and rivers from almost all the nitrogen runoff that otherwise would lead to biological anarchy. They've also stumbled across a new mystery: somewhere in the system are "black holes" into which vast quantities of nutrients simply disappear.

Ecologists have come a long way from being "mosquito counters." Now they track energy and elements as they cycle through an ecosystem. At SERC the sleuths continually run a fine-tooth comb across their open-air laboratory. Few things that enter or leave—be they as small as a nitrogen atom carried in a raindrop or as large as a new brood of beavers—escape their notice. NASA aircraft have overflown the site, measuring the density of tree foliage with laser instruments. The strength of the sun's ultraviolet radiation is measured every minute. Crabs wear sound-emitting devices so their movements and activities can be tracked. Few parcels of land and water have been so closely studied for so long.

Located 40 minutes east of Washington, D.C., in Edgewater, Maryland, the center takes in much of the watershed of the Rhode River, which flows into the bay. It's not a teaching facility, although more than 80,000 visitors have passed through in three decades. Unlike the situation at many universities, the different departments actively collaborate. As I wander the corridors and overhear people in blue jeans converse animatedly, I'm reminded of a small, cutting-edge computer company.

By dodging some of the constraints inherent to both academia and business, SERC has managed to do what others are often unable to do: conduct long-term studies. Funding cycles in science typically last only three to five years. But such "short-term" studies often miss the big picture in fields such as ecology, where complex natural cycles take many years to complete. Without studies lasting longer than the traditional three to five years, it is virtually impossible to detect and describe the slow, fundamental changes in an ecosystem or distinguish between mere episodic changes and significant trends. Some of SERC's work ranks as the longest continuously monitored ecological studies in the nation.

On a July day I accompany Tom Jordan to a cool, wooded glade adjacent to a field of corn. Underneath the canopy of tulip poplars and sweet gums sits a miniature tented kingdom. Plastic sheets cover gray PVC frames creating what looks like a row of tent barracks for toy soldiers, each tent about ten feet long but no more than a foot and a half high. Strings of thin plastic tubing—each its own garish fluorescent color—rise up from underneath every tent to nearby trees and pass through the branches and out of sight. It's like a New Age sculpture.

Jordan and I track the tubing to its destination: a cabin on blocks behind a tangle of brush. The tubing passes through a hole underneath the building. Jordan unlocks the door. Inside we are met with small lights glowing on scientific instruments, tables piled high with computer printouts, and a mysterious contraption shaped like a space-age cannon, which I learn contains a supercooled infrared laser.

Jordan and I watch as the apparatus snaps and clicks, sucking the air from Tent A into its main chamber. Captured with the more common components of the atmosphere are the trace gases exuded by the soil lying beneath Tent A. As the detritus in the soil decays, the nitrogen once locked up in the tissues of leaves, trees, earthworms and snakes is freed and moves back into the atmosphere. The laser sends a blast of photons through the sample. On an oscilloscope a green line dances, the

In a bird's-eye view of part of the research center, Muddy Creek (upper left) enters the Rhode River.

John F. Ross spent much of his childhood exploring Chesapeake Bay in small boats. His first visit to SERC was on a field trip when he was about 15.

Weirs there enable biologists to census fish species; white dots at lower left are carbon dioxide chambers.

peaks and valleys signifying, in this case, the presence of nitrous oxide, or laughing gas. Jordan and his colleagues believe the elevated levels of this compound come from fertilizer runoff from the cornfield.

Readings are taken day and night, the numbers flowing into a computer. It has not always worked perfectly. "When we first set up this experiment," says Jordan, "we found that the gas levels in one tent or another would suddenly drop. We finally figured out that field mice were chewing through our Day-Glo tubes."

Jordan is accumulating a comprehensive picture of denitrification, the process by which living things return the vital element nitrogen to the air. He is trying to shed light on one of the biggest mysteries in ecology: the case of the missing nitrogen. Once nitrogen was in limited supply. The nitrogen that is in the air is unusable by most organisms. Certain bacteria convert it to forms that can be used by living things. Humans have also learned to convert nitrogen to chemical forms that plants can use, thus creating "artificial" fertilizer. Sometimes conversion is inadvertent. Cars, for example, spew great quantities of nitrogen out their tail pipes; after some chemical changes it can be used by plants. Only a third to a tenth of human-produced nitrogen finds its way into streams and eventually the ocean. Where is the rest going?

To find out, SERC researchers try to follow it from its origins. Sometimes this means straying far from home. Dave Correll, the director, frequently heads north to the Pennsylvania Dutch country around Lancaster. The Amish farmland is quaint to tourists, inspiring to back-to-the-landers. To Correll, it's something else. "It's perhaps the most polluted area in the Eastern United States," he says. Amish lands border streams that feed the Susquehanna River, source of 50 percent of the bay's incoming fresh water. With each passing generation the land has been cut into smaller and smaller pieces. Some Amish farmers now actually fence their cattle into streambeds, saving the dry land for growing crops. Consequently, prodigious quantities of manure have loaded the streams with nitrogen. Correll has been able to set up high-tech measuring stations on a number of low-tech Amish farms.

Nitrogen, a component of proteins and nucleic acids (the DNA that ordains we grow up to be a person and not a palm tree), is crucial to every living thing. But nitrogen leached from farm fields into streams and rivers (and discharged from sewage treatment plants) overloads the system. It's a nutrient, and it causes massive blooms of the plankton that is always present. When all that plankton dies, decomposition uses up oxygen in the water. Nitrates from fertilizer get into the groundwater; pregnant women drinking it from wells may give birth to "blue," or oxygen-starved, babies. Scientists estimate that we have doubled the amount of available nitrogen in a few short decades.

Correll's work is predicated on the concept of the watershed, all that land that drains into a particular body of water. The bay's watershed covers 64,000 square miles, stretching from New York State in the north to the Alleghenies in the west. SERC's Rhode River, on the other hand, has a watershed of only 13 square miles. Along with Don Weller, Correll has mapped more than two-thirds of the Rhode River watershed with aerial photographs and ground truthing, covering the whole area on foot or by car to unequivocally identify what is shown in the pictures. The information is stored in computers in what is known as a Geographical Information System; it can produce maps of the watershed showing almost any features researchers request. Armed with water samples, for example, Weller can use the maps to trace the leakage of nutrients from croplands.

Weller, Jordan and Correll have shown that forestland bordering streams, known as riparian forests, can intercept most of the nitrates leaching from nearby agricultural fields. They and their colleagues have found that riparian forests are often scarcer in the Piedmont and Appalachian regions than along the coastal plain and

their own Rhode River. Even when riparian forests are present in those regions, however, the hydrology is different; nitrates flow underground beneath the root systems of trees and enter streams unimpeded. Thus, events in distant watersheds can have more impact on the bay than what happens close by.

What happens to nitrogen when it hits the bay is the province of Chuck Gallegos. He studies the smallest plant life in the water, the phytoplankton. When other conditions are right and a jolt of nitrogen arrives, these plants take in nutrients like teenagers inhaling pizza. In two weeks, 100 individuals become 100,000. These blooms cloud the water, cutting off the light to everything beneath them. Gallegos believes the blooms began a chain of events that have virtually wiped out sea grass—a habitat beneficial to blue crabs and myriad other species—in the bay. Dying plants on the bottom continue what Gallegos calls a "zipper effect": the dead sea grass releases nutrients that spur the growth of still more plankton, cutting off more light to more sea grass. Without sea grass anchoring the mud on the bottom, the water becomes more turbid, which cuts off still more light.

The offending organisms certainly don't look threatening under the microscope. The dinoflagellate *Prorocentrum*, for instance, is shaped like a toilet seat, its middle jam-packed with chlorophyll, the engine of photosynthesis. Individuals roll and pirouette across the slide like a wagon wheel flipping end over end down a steep hill. When its population explodes, however, it actually turns the water red.

Quantifying the link between Amish animal husbandry and dying sea grass beds is real-world science. Once ecologists spent much of their time studying old-growth forests or pristine lakes, trying to find out how "natural" ecosystems work. Today they have come to terms with the ubiquity of human impact. No ecosystem is truly isolated; all are influenced by neighboring ecosystems. Nutrients and energy pulse and flow between them. Ecologists follow these flow lines, trying to balance the overall amounts of materials entering and leaving—not unlike reconciling your checkbook. People in the business now speak of "landscape ecology"—the patchwork of ecosystem connections.

The places where two ecosystems meet appear to exert profound influences on both. Jess Parker (opposite), a SERC forest ecologist, likes to study the boundary between biosphere and atmosphere, the meeting of the leaves of a forest canopy and the air. Think about the forest not as a group of trees, he tells me, but as the interface between the atmosphere and the land. Above a forest it's often bright, windy, dry and noisy. On the forest floor the light is dim, the air is still and moist, and

Dennis Whigham (left) checks soil temperature in a study of how nutrients cycle through wetlands.

it is quiet. The very top of the canopy is a place of enormous activity—where most of the photosynthesis goes on, where water is evaporated and where many of the insects are feeding. We still know too little about the canopy because it is so hard to get there.

On a bright summer's day, Parker takes me out to a stand of trees where a 165-foot aluminum tower shoots up through the leaves. Countless times in the past eight years, Parker or one of his assistants has slipped into a harness, attached the harness to a cable running up the skinny and frail-looking tower—and climbed. On eight levels are devices that measure temperature, humidity, light, wind speed and carbon dioxide concentrations every 15 minutes. Around the base of the tower and scattered about the forest floor lie buckets that collect raindrops and others that collect leaf litter.

Parker has begun to paint a more complete picture of the canopy. What happens, for instance, to a raindrop falling from the sky? It may take anywhere from a few minutes to a half-hour to fall from a cloud to the tops of a forest's tallest trees. In the seconds the droplets fall from leaf to leaf, however, their chemistry is changed radically. They absorb both nutrients the leaves have exuded and pollutants the leaves have filtered from the air. Parker's research shows, for one thing, that a drop that reaches the ground (known as throughfall) can contain ten times more potassium than it started with.

The leaves are changed, too. Trees take up 90 percent of the acids in rain. How much damage this does is still the subject of both dispute and study. Acid rain clearly can harm aquatic organisms. SERC studies have documented the virtual extirpation of yellow perch in Muddy Creek as a direct result of increased acidity, itself the result of acid rain.

Waterborne pollution can travel considerable distances; nitrogen entering the bay may have come from Pennsylvania or even upstate New York. Air pollution travels farther: chemical analysis has shown that some of the molecules that land in the bay as acid rain started at the tail pipes of cars in Toronto and Detroit.

To study the canopy, Parker not only employs the tower but a squadron of silver pyramid-shaped helium balloons, which carry instruments to measure light and temperature, and sometimes video cameras. He's even grown quite adept at climbing ropes into the trees and snipping samples with a 15-foot pruning pole. "After an hour or so," he says, "I get the worst case of tennis elbow." Parker found still another approach when he learned that NASA geologists were using planes armed with laser altimeters to study the surface of the earth. Routinely the geologists were frustrated by "noise" that appeared in the data recorded over forests. In this noise

Anson (Tuck) Hines (center) sorts juvenile blue crabs, barometers of population fluctuations. High over the canopy Jess Parker (above) inspects instruments that measure wind speed, light, humidity and temperature.

Far from the Chesapeake, hydrologist Jim Duls checks a sampling station in Pennsylvania's Amish farm country. What happens here can have a bigger effect on the estuary than what goes on at the very edge of the bay.

Parker saw useful information. The instruments were measuring not only the topography of the ground but also the heights of trees and the density of the canopy. He persuaded NASA to fly the planes over the forest surrounding his tower. The data will give him an objective quantification of the spatial complexity of the canopy.

"You see," Parker says with a smile, "we'll manage our landscapes in the future by remote sensing." Satellite and aircraft imaging can uncover patterns about the health of large swaths of forest, providing early warning signs of stress brought on by drought or insect invasion. "With budget constraints being what they are," says Parker, "remote sensing will make on-the-ground inventories a thing of the past."

The SERC tract is being invaded by more than atoms from Detroit and Toronto. Once a week estuarine zoologist Greg Ruiz and his colleagues drive up to the Port of Baltimore. They board ships that have arrived empty from foreign ports, crossing the ocean with only ballast water to keep them from bobbing on the surface. The SERC team is looking for stowaways; when the ships release the ballast water prior to loading cargo, they dump an aquarium of creatures into the bay. On his desk, Ruiz shows me a large glass jar packed with foot-long fish, stowaways his team found. "If these mullet can hitch a ride in ballast water," he says, "think about the bacteria, viruses, plankton and larvae of other creatures that can."

Exotics arrive in the bay in many ways, not just in ballast water. In a soon-to-be-published paper, Ruiz's colleague, Anson (Tuck) Hines, assistant director of SERC, describes the invasion of a parasitic barnacle. When oysters were brought from the Gulf of Mexico for transplantation, it turned out that mixed in with them were tiny crabs that were carrying even tinier barnacles. These barnacles attach themselves to the undersides of mud crabs, which never grow larger than a quarter, and destroy their reproductive apparatus.

Hines has documented the parasite's slow spread through the bay from its introduction in 1963 to its invasion of the Rhode River in the late 1980s and up to the present. Within a few months after its arrival at the Rhode, three-quarters of the mud crabs in the river had been parasitized. Hines and Ruiz are following the course of the epidemic, documenting what happens when an exotic species hits a new ecosystem.

Exotics are a real hazard, but commercial fishing takes a more direct and immediate toll on certain bay delicacies. Hines is most interested in the impact of fishing on the blue crab, the bay's dominant nonhuman predator. While other SERC scientists study ecosystems from the bottom up, beginning with nutrient flow, Hines looks at how predators influence the estuarine

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ecosystem from the top down. Hidden on the bottom, blue crabs feast on clams, crustaceans and each other. It was a world we knew little about until Hines and his colleague, Thomas G. Wolcott of North Carolina State University, came up with the concept of "robo-crabs." They developed a series of unique biotelemetry devices that strap onto the shell of a crab like a backpack.

Nightfall may find Hines with a boatful of colleagues tracking the movements of a single blue crab on the muddy floor of the bay. Using hydrophones, Hines hears a regular beeping. Every once in a while the soporific beat is interrupted by a screech. The crab is eating again. A device inserted in the muscle that controls chewing monitors the electrical signals generated when the muscles contract.

Although he can't see the crab, Hines knows what it is eating. "To a crab," says Hines, "the difference between a clam and a fish is that one is hard on the outside and soft on the inside, while the other is soft on the outside and has a hard backbone and skull on the inside." Rapid chewing followed by pauses, he explains, means the crab is dining on a fish. When the pattern reverses, a clam is the main course.

Hines and his colleagues have designed other devices that record fighting, molting and mating. The resulting picture of blue crab life does not invite phrases like "beautiful swimmer." Life is competition, fighting, cannibalism. Small crabs, he finds, seek refuge from larger ones in the shallow waters near the shore. It is exactly this habitat, so critical for the success of crabs, that often is destroyed by homeowners who build bulkheads in front of their homes, eliminating that shallow water. The biggest impact on blue crab populations, however, comes from commercial fishing, which selectively removes large males. The females have to rely on smaller males, which do not have as much sperm.

Of all human impacts on the environment, one of the strongest is the steadily rising level of carbon dioxide in the atmosphere. There has always been a greenhouse effect produced by naturally occurring water vapor, carbon dioxide and a number of rare gases. (Without it, the world would be colder by 95 degrees F—most of the oceans would be frozen.) But the level of carbon dioxide in the atmosphere has risen an estimated 30 percent since the beginning of the Industrial Age. Some scientists have calculated that the resulting intensification of the greenhouse effect, over time, could melt polar ice and flood coastal cities and island nations. For the past nine years, SERC's Bert Drake, a plant physiologist, has run experiments on the more subtle impact that rising carbon dioxide levels might have on plants. A jovial man who's fond of keeping a Scottish terrier named Bob at his side, Drake oversees a battery of transparent chambers on the marsh alongside Muddy Creek. Inside them, Drake is exposing marsh plants to twice the current level of carbon dioxide in the atmosphere. He has found that plants respond by increasing their rates of photosynthesis while slowing their respiration (the nighttime release of carbon dioxide back into the atmosphere). Drake believes that as carbon dioxide levels rise, more and more carbon will be locked up in ecosystems. That's probably a good thing, he says, because it will slow the accumulation of carbon dioxide in the atmosphere and the climate changes that will ensue.

The growing levels of carbon in living things could be the answer to the missing nitrogen that has so perplexed Tom Jordan. It's these poetic full circles that keep SERC scientists entranced. "I believe," says Jordan, "that the lion's share of nitrogen could be locked up with the extra carbon in the biomass, such as trees." Simply put, the higher levels of carbon dioxide stimulate photosynthesis at a higher rate, creating more biomass. Because all life needs nitrogen, this new organic material sucks up more and more nitrogen.

As I walk among the chambers in the marsh and peer into each one, I try to discern the differences between high carbon dioxide grasses and normal ones. Nothing sets them apart to my eye. That always will be the reality of much of the work here as the staff probes the unseen and the invisible. Yet, as I stare into another chamber, I distinctly feel I am looking into the future, of ecology in general and as shaped by rising carbon dioxide levels. This study and all the others are fuzzy crystal balls that tell us the future. They tell us how we will live and survive. And they tell us once more that everything really is connected to everything else, only in ways even more complex than we ever dreamed.

Aboard a coal carrier from Israel, SERC's Annette Frese checks for stowaways in the ship's ballast water.

Dumas was one of the first novelists to publish serially. An ad for *The Count of Monte Cristo* (opposite) offers the inaugural issue free.

By Victoria Foote-Greenwell

The life and resurrection of Alexandre Dumas

The grandson of a Haitian slave, he became the most famous author in France; now, his rousing Romantic novels are enjoying renewed popularity

When Alexandre Dumas built his estate in Port Marly in 1846, he didn't cover his Gothic cottage in wisteria but in words: 88 titles of his works. The titles carved in stone proved an unnecessary safeguard against oblivion: 150 years later they abound both in print and on screen. Though many today know his works, few know that Dumas, the most successful author of 19th-century France and one of the greatest storytellers of all time, was the grandson of a Haitian slave.

Dumas (known as Dumas *père* to distinquish him from his son, Alexandre, or Dumas *fils*) had to confront poverty, lack of education, censorship and slander, and the insidious wear and tear of 19th-century racism. Mademoiselle Mars, the leading lady at the Comédie-Française, once yelped as the gangly, young playwright departed, "Open the windows. It smells of Negro!" And yet, Dumas would eventually befriend princes, help the cause of three revolutions and have a French magazine today trumpet one of his novels as "the most read book after the Bible."

For a long time Dumas was treated with condescension by academia as a mere plebeian entertainer. More recently his reputation has been hampered by the 20th-century credo that endorses spare, analytical writing and minute psychological revelation. Dumas's skills run in quite the opposite direction: instinctive heroes, voluptuous atmosphere, a galloping narrative and breakneck dialogue. But in the past few years academic scholars have shown a renewed interest in the writer. They point out that before he was 35, Dumas contributed to French literature by laying the foundations of bourgeois drama, and helping to popularize history and create a new kind of Romantic novel.

Dumas's popular bequest is profoundly anchored. His books, translated into nearly a hundred languages, are selling briskly. In 1993, there were 140 million copies of his works sold in the former Soviet Union. In 1994, French publishers printed 17 new editions, including 8 alone of *Queen Mar-*

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General Dumas, the author's father, was famous for his ferocity in battle.

got, on the French best-seller list that summer and reissued in the United States because of the screen version starring Isabelle Adjani. Twenty-two new editions of his stories were released in France in 1995, and nine never-before-published texts, stories and essays are scheduled for release this fall. Next year, *The Count of Monte Cristo,* which has already generated some 50 films, is expected to appear on French television with international screen star Gérard Depardieu in the title role. *The Three Musketeers* has been fodder for at least 60 films and spin-offs, including a 1993 Walt Disney remake of the same title, and *D'Artagnan's Daughter,* a faithfully imagined romp released in 1994 in France and 1995 in England.

The magical estate that Alexandre Dumas created outside Paris is now fully restored and open to the public. The neo-Renaissance chateau, just paces down the hill from the Gothic pavilion where he worked, is wreathed with his initials and sculpted with portrait medallions of his favorite authors, from Homer to Sir Walter Scott. Above the front door is a medallion of Dumas himself.

Victoria Foote-Greenwell, who lives and works in Paris, writes on travel and culture for Time *magazine.*

Recent studies have begun to dismiss the longstanding view of Dumas as the naive bon vivant. Instead, a more complicated image emerges, of a man who triumphed in spite of a society that rewarded him for his talent while expressing its disdain for him.

The prejudice Dumas encountered was usually more subtle than overt, but enemies could be baldly bigoted at times. A gentleman once began to make racist remarks within earshot, and when he finally said, "Mr. Dumas probably knows a thing or two about Negroes, since so much black blood runs in his veins," Dumas coolly responded, "Yes, of course. My father was a mulatto, my grandfather was a Negro, and my great-grandfather was an ape. You see, sir, my family began where yours left off."

His family tree began in the Caribbean island of Santo Domingo. Dumas's father, Thomas-Alexandre, was born in 1762 to a beautiful black house slave, Cessette Dumas, and to her owner, the Marquis de la Pailleterie, who had left Normandy to seek his fortune as a sugar planter. The marquis returned to Europe in 1775, though not before selling off his four children, a practice not uncommon at the time. He later bought back his 14-year-old illegitimate son and had him brought to France. The young man eventually broke off ties, took his deceased mother's name and entered the army. Promotion to lieutenant colonel was the carte blanche that allowed the handsome mulatto to marry an innkeeper's daughter, and his rapid climb up the ranks continued.

At 31 he became a general and soon began serving under Napoleon Bonaparte. The feats he performed and the wrongs he suffered read like scenes from a Dumas novel: he held a bridge alone against a squadron of men, cutting them down as they came two and three abreast toward him, sustaining three wounds and seven bullet holes in his cloak as he halted their advance. They named him "the black devil."

Soon he and Napoleon fell out, and thereafter Napoleon referred to him as "that Negro Dumas." Still, the general served honorably, seizing a treasure worth millions and sending it to Napoleon with a note: "Should I be killed or die . . . remember I have left behind me in France a wife and child."

But when the general left the ranks for France, he was captured, imprisoned and poisoned by the enemy, resulting in ulcers, partial paralysis and blindness in one eye. Freed after an 1801 armistice, he was denied back pay and a military pension by Napoleon.

A year after his return, in Villers-Cotterêts, Madame Dumas gave birth to a boy christened Alexandre. The general died penniless in 1806 but not before instilling in his son a sense of the heroic. Alexandre's frugal childhood was spent hunting in the nearby woods. He had his first brush with social outcasting by the local nobility when he was insulted at a ball for wearing his undersized communion suit. At 13 Dumas felt the first tingling of ambition. An older friend, Auguste Lafarge, wrote a witty epigram revenging himself on the girl who had jilted him, and soon the whole county was reciting the stanza. Noted Dumas: "I must admit that all the brouhaha around his name . . . made my head spin. I wanted the glory of having others speak of me even when I wasn't there."

In 1840s cartoon, Dumas is unable to enter the lofty Académie Française.

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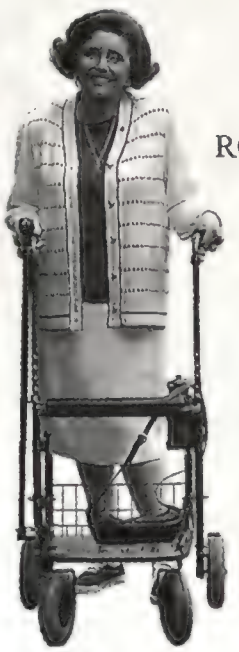
Dumas and son (mounted, center and right) travel with friends in Spain.

The youngster must have been equally impressed by the power of the pen to settle a score.

In 1822 Dumas visited Paris for the first time. Once back home he happened to play billiards and traded his winnings—600 glasses of absinthe—for 12 round-trip tickets by coach to the capital. Within a year he took the trip to Paris one way. He realized he had nothing to barter for room and board but his wits, an elephantine memory and graceful handwriting. This last landed him a modest job as a copyist for the duc d'Orleans. Before long Dumas was attending the theater nightly and staying up until dawn reading Corneille, Milton and Schiller. He soon began writing poems, short stories and maudlin melodramas.

Dumas won a place at the dinner parties of Charles Nodier, a central figure in the French Romantic movement, and in time he became friends with Victor Hugo, Lamartine and George Sand. Dumas made his name and set off a Romantic revolution in theater with *Henry III and His Court*, the first in a series of historical plays and novels that featured the hapless 16th-century king and his conniving mother, Catherine de Médicis. After



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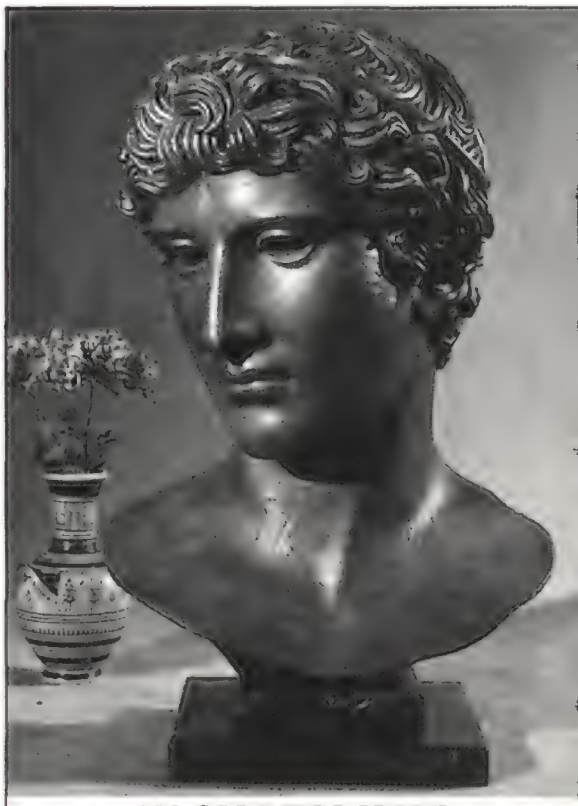

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the February 1829 premiere at the Comédie-Française, the young partisans of Dumas's drama chanted "Down with Racine, down with Voltaire!" and tried to heave the marble busts of classical authors out the foyer windows. In several hundred lines Dumas had liberated theater from the shackles of restraint, verse and the sacrosanct unities of place and time. He also showed on stage the physical brutality that traditionally happened off: the duc de Guise, trying to force a confession from his wife that she has a lover, crushes her hand in his iron gauntlet.

Dumas also anticipated modern social drama. He was one of the first French playwrights to depict characters in contemporary costumes and settings, and to conclude a play on a spine-tingling note. In 1831 *Antony* wowed the crowds when the illegitimate hero, in an effort to protect the honor of his dead mistress, tells her husband in the final curtain line: "She resisted me so I killed her!"

The amorous Dumas often courted his actresses and tallied up 28 mistresses in his lifetime. He had three children: a son born in 1824 that he legally wrested seven years later from the child's mother, a dressmaker; a daughter born to actress Belle Krelsamer in 1831; and another daughter born in

ALEXANDRE DUMAS, par GILL

Dumas said caricatures were the only portraits that captured his likeness.

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A 1902 newspaper honored Dumas on the 100th anniversary of his birth.

1860 whom he adored in old age. He was married briefly to mediocre actress Ida Ferrier in the 1840s. .

A revolution in the way newspapers were sold provided the next jump up in Dumas's flourishing career. In 1836, when newspapers were bought by yearly subscription only, the newly launched *La Presse* sold cheaply and by the issue. To lure readers and to keep them, a new formula proposed: "Next episode in tomorrow's edition." With his *Countess of Salisbury*, set in the 14th century, Dumas helped develop the *roman-feuilleton*, or serial novel, and his run-on stories were soon highly sought after by the public.

As his star rose and his fortunes with it, Dumas became a target for newspaper satirists and salon squatters, resulting in a succession of duels and lawsuits. Mostly he was criticized for his prodigious output and for using ghostwriters. He openly admitted to collaborating with other writers, a practice in wide use at the time. He was also attacked for playing fast and loose with historical facts. When accused of raping history, he responded, "Yes, but look how beautiful the children are."

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In a period of savage caricature, Dumas was a moving target for cartoons. "*Mon fouilli tropical*" ("my tropical tangle"), as he called his hair, was grist for dozens of drawings.

A lesser man might have buckled under so many offenses, but Dumas found productive ways to fight back. His works confront not only society's stigmas against illegitimacy and divorce, but also the horrors society inflicts because of race. In *Georges*, Dumas describes the insurmountable prejudice encountered by the wealthy son of a mulatto planter on the island of Mauritius. The hero's struggle is interwoven with plans for a slave revolt and set against a background of imperialist French and English forces vying for control of the island.

In addition to *Georges*, Dumas wrote *Ingénue*, a novel of the French Revolution published in 1853, in which he gives a gut-wrenching account of the slave trade and an impassioned plea for abolition.

Dumas was ardent about all forms of social injustice and, to the end of his life, was a true political activist. In July 1830 the barricades went up all over Paris to finally protest the reign of the conservative Bourbon king, Charles X. Dumas grabbed two pistols and went down into the street to help. He commandeered a coach for the town of Soissons, where he ordered the local commander to turn over a supposed store of 200 pounds of gunpowder. With a battle-ax Dumas broke down the wooden doors and stumbled onto a mother lode: a ton and a half of explosives. He and anti-Bourbon rebels escorted the powder back to Paris where they were congratulated for their efforts. In 1860 Dumas used his 78-ton schooner *Emma* to personally run guns to the Italian Republican patriot Garibaldi.

Dumas seemed to find opportunity and adventure in even the worst of situations. When an initial need to flee emotional entanglements and problems with creditors led him to travel through France and other European

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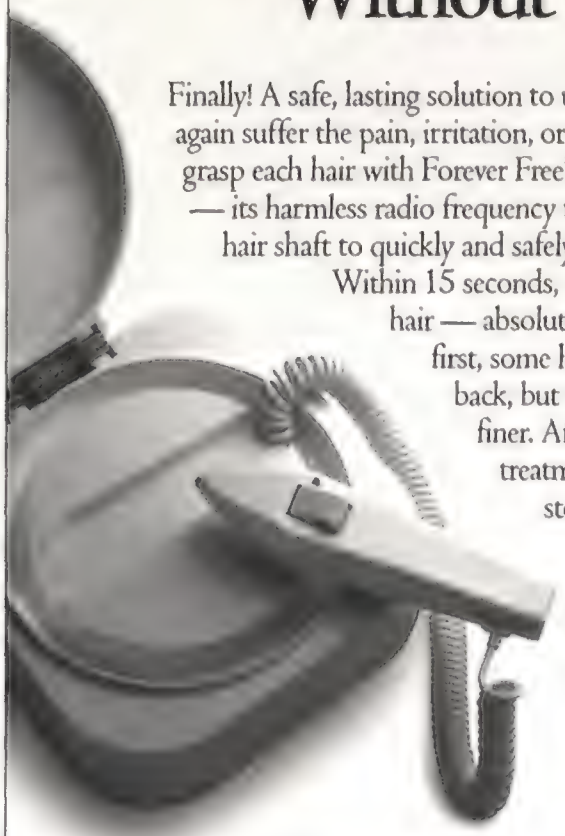

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The rollicking adventures of "The Three Musketeers" have inspired more than 60 films, including director George Sidney's high-spirited 1948 version starring (from left) Van Heflin, Gene Kelly, Gig Young and Robert Coote.

countries, North Africa and Russia, he churned out sprightly travelogues, which became fodder for future fiction. During a trip to the island of Saint-Marguerite he took notes on the man in the iron mask, the mysterious figure unfairly imprisoned for 40 years. This tale of inequity would resonate for Dumas and inspire the plot of *The Viscount of Bragelonne*, the last book in his Musketeer trilogy.

Dumas's recourse from society's pressures was to write, and the theme of arbitrary injustice and subsequent redemption would bubble to the surface of many of his works. In 1848 Dumas asserted that he had written for 20 years at an average of ten hours a day. He wrote a full-length play in three-and-a-half days, a one-act play in an afternoon. His published works, including novels, novellas, dramas, memoirs and travel books, total about 300. He also published eight newspapers and was the only writer for some of them.

But as Dumas wrote in 1857: "As always I search in my work for a distraction from my distress." This was his cure also for physical ailments. One night his son, Alexandre Dumas *fils*, found the elder Dumas awake. "Can't you sleep?" he asked.

Richard Lester's hilarious 1974 movie about the Musketeers stars (from left) Frank Finlay as Porthos, Oliver Reed as the noble Athos, Michael York as the brash young hero, d'Artagnan, and Richard Chamberlain as the refined Aramis.

"No, I've been walking."

"You don't feel good?"

"My stomach aches. When I get that, I walk. When it gets worse, I read."

"And what about when it gets too painful to read?"

"I work."

If his work provided solace, it also yielded considerable riches. In 1840 the average worker's salary was 3 francs a day; one line from Dumas's pen was worth 3 francs. He earned 80,000 francs in a single year and was not yet at the height of his success.

In the 1840s he bought up nearly 13 acres of forest and fields overlooking the Seine Valley. Though he initially wanted a small country house as a retreat from Paris, Dumas got carried away and pushed his architect, Hippolyte Durand, to ever more fanciful designs. Construction began in 1845. When it was finished the initial budget of 48,000 francs had ballooned to more than 200,000 francs. The worldly writer Balzac clucked over the price of what he called "one of the most delicious follies ever built."

Dumas was entranced with what he called his "paradise on earth in miniature." In the summer of 1847 he invited 50 people to his sumptuous house-

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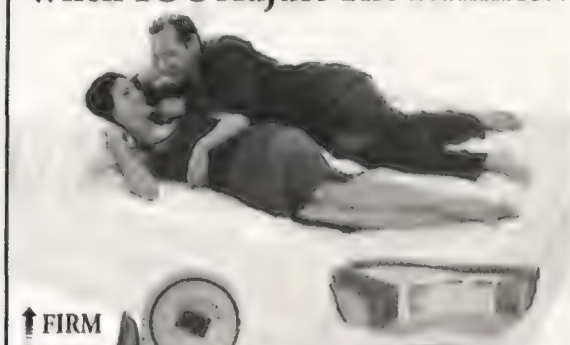

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warming; instead 600 turned up to see the house that was the talk of Paris. Thereafter Dumas would write in his moated pavilion while the beau monde, including strangers, milled in the chateau with his mistresses and friends, his children, dogs, cats and a pet vulture. One of his detractors wrote: "Everywhere ostentation and lack of taste . . . morals of a most extravagant nature were the rule here."

In less than a year the estate had swallowed up more than half a million francs, and Dumas went bankrupt. Pressed by his creditors, Dumas eventually had to sell the house for a seventh of what it had cost.

The one house Dumas was able to call home was slated for demolition in 1970. But an appeal by French historian Alain Decaux prompted thousands of letters of protest, and Monte-Cristo was bought by the local townships.

Today the public can see the park as it once was, a meandering tract of rock gardens and roses, bridges and waterfalls, man-made pools and grottoes that lead the way to the author's Gothic pavilion, which is still guarded by a stone dog asleep in a stone doghouse. The motto over the door of the chateau itself succinctly captures the duality of Dumas's nature, his generosity and his narcissistic delight in adulation: "*J'aime qui m'aime*" ("I love those who love me"). Inside, the rooms trace Dumas's life and heritage, beginning with his grandfather's chateau in Normandy and ending with his son, Alexandre Dumas *fils*, who would go on to write the celebrated *La Dame aux Camélias*, later adapted in Verdi's *La Traviata*.

The French have a hardheaded saying: "Revenge is a platter best tasted cold," and Dumas's sweetest of desserts is his enduring success. Dumas *fils* went on to be a guiding force of modern drama. Unlike his father, but to the elder's delight, he was inducted into the hallowed Académie Française. As for the offspring of Dumas's imagination, they are alive and well today in the bookstore, on the

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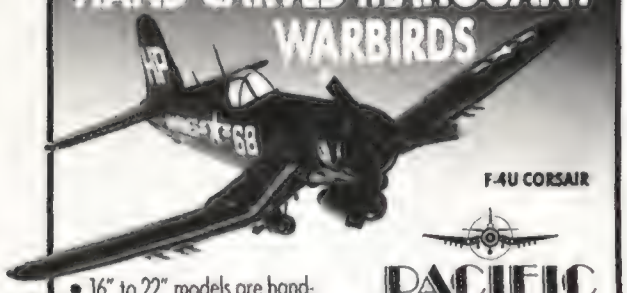

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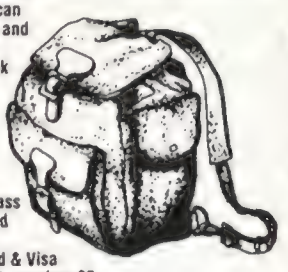

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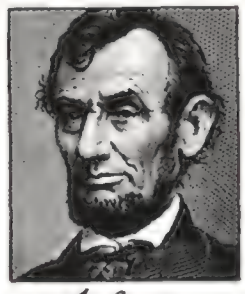

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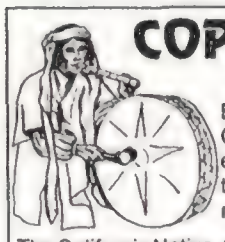

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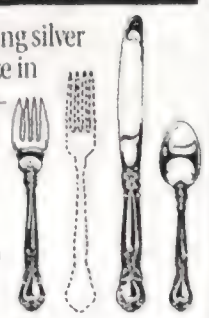

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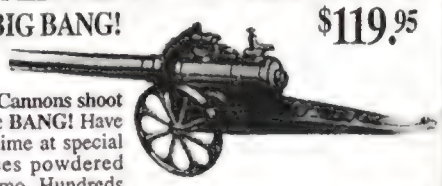

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college syllabus and on the marquee.

All this even though the novels are clearly books of their time. Consider the best known of them, *The Three Musketeers.* Long, theatrical, at times preposterous, its pages are filled with improbable coincidence and dialogue worthy of a modern-day bodice-ripper: "Buckingham seized her hand and kissed it passionately. Then he got to his feet and said: If I escape alive I shall see you again before six months have passed, even if I have to set the world ablaze to reach you."

But the book, awash with derring-do and sly comedy, is also great fun to read. The Musketeers twirl their mustaches, clank their swords, and dispatch with aplomb the minions of the villainous Cardinal Richelieu. The hot-blooded young d'Artagnan—"our hero"—has an "I'm as good as you are and tell me I'm not" air about him, and manages to get himself into—and out of—one scrape after another. Fresh from the country on his second morning in Paris, he manages in separate encounters to offend Athos, Porthos and Aramis, and challenges each to a duel. The three master swordsmen all turn up at the appointed time and place, and are astonished to find themselves facing the same bumptious youth. Providentially, a squad of the Cardinal's henchmen appears, d'Artagnan joins the Musketeers in routing them, and the four are henceforth as brothers.

Scenes like these, of course, make Dumas's books a treasure trove for celluloid. His novels and plays have generated more than 200 films and spin-offs, as well as innumerable shorts and cartoons.

In a recent best-selling literary whodunit, *The Dumas Club* by the Spaniard Arturo Perez-Reverte, the Dumasian scholar-narrator declares in vivid apologia: "*The Three Musketeers* has lost none of its freshness, in spite of the evolution in taste and the stupid discredit in which action has fallen. Ever since Joyce, we are forced to resign ourselves to Molly Bloom. . . ." Cer-

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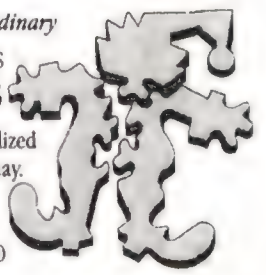

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tainly modern literature has run out of stories, and worse yet, has also run out of heroes. Camus and Beckett gelded their heroes, the self-obsessed stranger diddling with his second thoughts, the two tramps waiting morosely for Godot. America had its cowboys and Superman. Luckily, France has d'Artagnan and his triumvirate: the earthy Porthos, the spiritual Aramis and the noble Athos. The tale has guided generations who learned their moral standards from the Musketeers: to behave well, or to misbehave in style.

Undying friendship and loyalty is a dicey proposition anywhere but on a printed page. With their succinct motto ("All for one, one for all"), d'Artagnan and the Musketeers offer us the best of male bonding, dispensing in one sword sweep with the more anguishing issues of ambivalence and the Other.

In *The Count of Monte Cristo* the hero, Dantes, is now being viewed as a Promethean figure, even a Nietzschean superman. "Farewell to all feelings that warm the heart," says Dantes, as he leaves Marseilles after coming to the aid of a friend. "I have been Heaven's substitute to recompense the good. Now let the God of vengeance yield me the power to punish the wicked!" Omniscient and omnipotent, Dantes systematically ferrets out his old enemies and avenges himself on them. The story is a fantasy of justice and divine retribution, in a cantilevered universe oblivious to such moral order.

On his deathbed Dumas asked his son, "Will I be remembered?" Dumas was an old man by then, had toted the weary load in exemplary fashion and can thus be forgiven for asking such a question. Against all social odds Alexandre Dumas joins the immortal pantheon of the great men of letters.

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Book Reviews

Coming of Age With Elephants: A Memoir
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Joyce Poole has devoted most of her life to Africa's elephants. She has lived so long in Kenya, she says, that, although American by birth, "in my heart I am African." Her scientific work has earned her a considerable reputation in the field of behavioral ecology, and she has immersed herself so deeply into elephant society that she sometimes finds herself looking at the world "through the eyes and ears of the elephants."

The daughter of a Peace Corps executive, Poole spent much of her childhood in Africa. By the time she was 11, Poole had decided to become a biologist. In 1975, after her freshman year in college, she returned to Kenya to work on an elephant project in Amboseli National Park.

For Poole, fieldwork was "like reading a long novel that you don't want to end"; her next seven years were astonishingly productive. She spent months assembling a catalog of the bulls, following them closely—and fleeing madly when the elephants thought she was being too intrusive in her attempts to record male-male aggression or collect fresh urine samples. (She wanted to measure the urine's testosterone content to confirm her discovery that African elephants, like their Asian cousins, went through a sexually aggressive phase called "musth.") In an academic performance that matched the bravura of her fieldwork, she finished her PhD in 1982.

Poole's personal life, however, wasn't going nearly as well. Her father was killed in a car accident in 1978. A lover abandoned her. Finally, on a picnic in the Ngong Hills near Nairobi in 1984, she and a fellow researcher were raped. And, while she stuck with her work in the park, things were going badly for the elephants, too.

The root of the problem was ivory. Prices were skyrocketing, poachers were slaughtering, and officials in the Kenyan government were making fortunes from the illegal trade. The extent of the corruption finally became clear to Poole in 1988, when an aerial survey of Tsavo National Park indicated that 5,000 to 7,000 of Tsavo's elephants had been killed during the previous eight years—an appalling average of about two deaths per day. Worse still, the park's own rangers were participating in the destruction of the elephants.

Elephant scientists have known for decades that these animals have elaborately structured social lives. Senior females, "matriarchs," lead small families constituted into clans, which relate to each other, to groups of males and to the landscape around them in complex ways. Young elephants learn these patterns from their elders. Poachers were doing more than killing individual animals. By selectively targeting mature adults, they were destroying the foundations of elephant society.

Harassed in her day-to-day field studies and disillusioned by the corruption she had encountered in the parks, Poole left Amboseli to work on stopping the ivory trade. The business, both legal and illicit, was making many important Africans rich. The key to the problem was to have elephants declared an endangered species. Finally, in October 1989, Poole and her colleagues achieved this end, and the ivory trade now has been largely stopped.

What looks like a happy ending for the animals is paralleled by a happy ending for Poole. Her friend and supporter, Richard Leakey, appoints her to coordinate the Kenya Wildlife Service's elephant program, she has a baby, and at book's end she is surrounded by friends in a home of her own on the edge of Kenya's Rift Valley.

But Poole warns us that elephants remain threatened by both political and economic forces, and the similarities between her story and the elephants' make us wonder about her future as well. It is a measure of success, on many levels, that we genuinely care how these twin stories will turn out.

John R. Alden, an anthropologist and reviewer, lives in Ann Arbor, Michigan.

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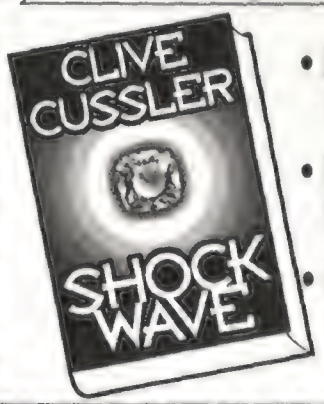

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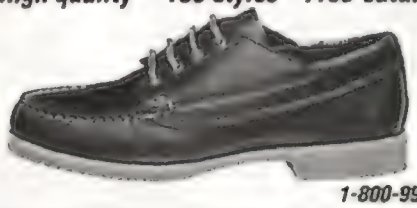
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By Donald Dale Jackson

When Dad makes tennis a family game, 'love' means more than zero

My father learned to play tennis as a young man in Washington, D.C., in the 1930s. The game had not been an option in the little Missouri village where he grew up, though he did make one doomed effort to bring the sport to his hometown. As he told the story, he was seized with an impulse to play on a trip home soon after he learned the game, so he and a cohort rigged up a makeshift net and painted lines on a patch of relatively flat cow pasture. The trouble was that the ignorant cows kept wandering onto the "court."

Beginning in Washington, he played at least once a week for about 55 years. Tennis was his outlet; it was one of the ways he expressed himself; it was a vehicle for learning and teaching, and in the end it was part of his personality.

My dad played doubles a couple of times a week with six or eight friends at a nearby two-court park. I noticed that his opinion of his friends often stemmed from some aspect of their tennis game. One man would curse when he missed a first serve and announce that now he would probably double-fault, and he usually did. My father figured the man hexed himself. Dad had little use for the guy who gave himself the benefit of the doubt on close calls, and I remember him lecturing me on the man's smallness of character. A man who never brought balls was another target of his scorn for his cheapness.

Tennis is a revelation of character—the way we play is the way we are. My father tried to teach my brother and me when to be patient, to wait for our chance, and when to be aggressive and close for the kill. The game demands a mastery of one's impulses and a calmness in moments of anxiety, useful lessons beyond the court. When I played in junior tournaments, he would show up, but not to coach—just to be there in silent support, sometimes drifting among the trees like a shadow a hundred yards or so from the court.

Tennis gave him his friends, and he made tennis integral to our family life. We all loved to play, in some degree because it was a way to be close to him. My wife once said that the most recurrent conversational topic among the men in our family was volleys, the discussions often disagreements on the best way to hit a shot at net. The people he felt closest to, those who sat around our kitchen table on weekends making each other laugh, were the men he played tennis with. Maybe he felt you could always be yourself with someone who knew that much about you.

Dad had been burdened from infancy with a name he constantly had to explain: Zalph. Never in his long lifetime did he meet another Zalph, nor have I. He would tell people that it was like Ralph with a Z. I found it interesting that in most of his business associations (he was a lawyer) and among casual acquaintances he was known as "Jack." Zalph was too much to deal with. But his tennis friends always called him Zalph.

Humor was part of every match, as it was part of his personality. He maintained a running commentary during points. When an opponent at the net left the alley open for him to hit one down the line, he would say something about "no forwarding address." When he was cleanly passed, he would sometimes remark that his foe didn't have that shot yesterday. He would berate himself as well. "Give me a couple of days and I'd get to that one," he'd say, or "If I was any slower you would have to paint me." He always liked to write, and he sometimes composed poems or limericks on a tennis theme. I remember one about the friend with a poor record for bringing balls: It was called "The No-Ball Prize."

When he began to slow down he played a more stately and guileful game at a relaxed pace. He and his friends would play a set and then tell stories for half an hour before playing another. This was a concession to age that made sense—and it was another lesson in the interplay of tennis and life.

My father always told me that one attraction of tennis was that you could play all your life. That was the reason to teach it to your kids. And in his case it turned out to be close to true. He was 79 when he finally gave it up. He had fallen a couple of times because of numb feet and ankles—"bad wheels" as they say in sports—and he had emphysema and heart trouble. His condition took a nosedive as soon as he stopped playing. Within a year he was obliged to use a walker, then he couldn't drive, then he hardly went out at all.

When he died not long ago, a couple of his lifelong tennis friends, still playing at 88 and 90, made it to the funeral. One stood up at the service and spoke about what a gentleman Dad always was on and off the court and how much fun he was to be around. The other man saved his memories for the reception afterward. He pulled out an envelope filled with tiny pieces of paper bearing typed poetic messages that looked like the ones in fortune cookies. My father had apparently distributed them at a birthday party some years earlier.

His old friend read them aloud. The first said, "With foot, ball and racket all in right place, maybe '78 will bring you an ace." The next was, "Join the move to cut down cursin', and stop bangin' the ball at the fat netperson." And finally, "You handsome, you jolly, how come lousy volley?"

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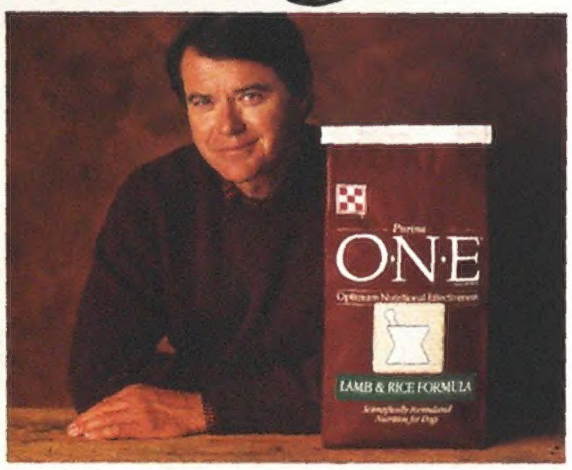

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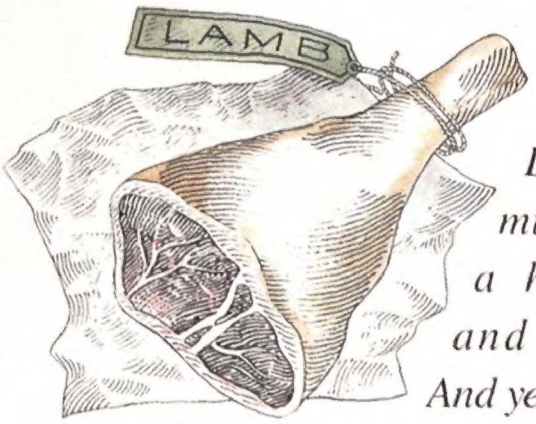

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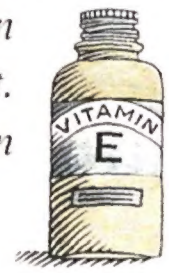

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